Minerals Yearbook 1968

Volume IV

AREA REPORTS: INTERNATIONAL

Prepared by staff of the

BUREAU OF MINES

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UNITED STATES DEPARTMENT OF THE INTERIOR • Walter J. Hickel, Secretary

BUREAU OF MINES • John F. O'Leary, Director

Created in 1849, the Department of the Interior—America's Department of Natural Resources—is concerned with the management, conservation, and development of the Nation's water, wildlife, mineral, forest, and park and recreational resources. It also has major responsibilities for Indian and Territorial affairs.

As the Nation's principal conservation agency, the Department works to assure that nonrenewable resources are developed and used wisely, that parks and recreational resources are conserved for the future, and that renewable resources make their full contribution to the progress, prosperity, and security of the United States—now and in the future.

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553

Foreword

The 1968 Minerals Yearbook provides a record of performance of the world's minerals industries during the year of review, with sufficient background information to interpret the year's developments.

Volume I–II, Metals, Minerals, and Fuels, contains chapters on the metal, nonmetal, and mineral fuel commodities essential to the domestic economy. In addition, it includes a general review chapter on these industries, a statistical summary, and chapters on employment and injuries, and technologic trends.

Volume III, Area Reports: Domestic, contains chapters covering each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, the Commonwealth of Puerto Rico, and the Canal Zone. This volume also has a statistical summary chapter, identical with that in Volume I–II, and a chapter on employment and injuries.

Volume IV, Area Reports: International, presents the latest available mineral statistics for more than 130 foreign countries and areas and discusses the importance of minerals to the economies of these nations. A separate chapter reviews minerals and their relationship to the world economy.

The Minerals Yearbook is the most comprehensive publication of its kind available, and the Bureau will continue its efforts in the years ahead to increase the Yearbook's value to its many users. Toward that end, the constructive comments and suggestions of readers are invited.

JOHN F. O'LEARY, *Director*

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Acknowledgments

The Bureau of Mines gratefully acknowledges the information and basic statistical data on mineral commodity production, consumption, and trade which were obtained from foreign mineral agencies and from the official statistical publications issued in various countries. Many useful data were also obtained from publications of the United Nations, from airgrams of the Department of State, and from both the domestic and foreign technical and trade press. Indispensable to the preparation of this volume were the routine and special reports received from technical, mineral, and petroleum attachés and other members of the embassy and consular service of the Department of State, and their contribution is deeply appreciated.

The individual chapters of this volume were prepared by the staff of the Division of International Activities with contributions from various members of the Foreign Service. Final correlation and checking of this volume was performed by the Minerals Yearbook staff under the direction of Kathleen J. D'Amico.

The regimes of some of the countries and areas reviewed in this volume are not recognized by the U.S. Government. The information contained herein is technical and statistical and is not to be construed as conflicting with or contradicting U.S. policies toward these countries.

ALBERT E. SCHRECK,
Editor-In-Chief

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Contents

	Page
Foreword, by John F. O'Leary	III
Acknowledgments, by Albert E. Schreck	V
Minerals in the world economy, by Edgar J. Gealy and Charles L. Kimbell	1
Algeria, by Edgar J. Gealy	51
Angola, Mozambique, and Portuguese Guinea, by Eugene R. Slatick	59
Argentina, by Garn A. Rynearson	69
Australia, by Lester G. Morrell	81
Austria, by Roman V. Sondermayer	101
Belgium and Luxembourg, by Roman V. Sondermayer	111
Bolivia, by Robert A. Whitman	125
Brazil, by F. W. Wessel	131
Bulgaria, by Roman V. Sondermayer	143
Burma, by Arnold M. Lansche and K. P. Wang	149
Canada, by Lester G. Morrell	153
Chile, by Garn A. Rynearson	173
China, mainland, by K. P. Wang	189
Colombia, by Gordon W. Koelling	201
Congo, Democratic Republic of the (Kinshasa), by Eugene R. Slatick	211
Cyprus, by Eugene R. Slatick	217
Czechoslovakia, by Bernadette Michalski	221
Finland, by F. L. Klinger	227
France, by L. Nahai	237
Gabon, by Edgar J. Gealy and Agnes J. Doughman	267
Germany, East, by Bernadette Michalski	273
Germany, Federal Republic of, by L. Nahai	279
Ghana, by Edgar J. Gealy and Agnes J. Doughman	311
Greece, by Bernadette Michalski	319
Hungary, by Joseph B. Huvos	327
India, by Charles L. Kimbell and Charles W. Sweetwood	335
Indonesia, by Arthur F. Grube	355
Iran, by David A. Carleton	365
Iraq, by Edgar J. Gealy and Agnes J. Doughman	373
Ireland, by Columbus R. Gentile	379
Israel, by Walter C. Woodmansee	387
Italy, by F. L. Klinger	397
Japan, by Ta Cheng Li and R. A. Pense	421
Kenya, Tanzania, and Uganda, by Eugene R. Slatick	445
Korea, North, by R. A. Pense	455
Korea, South, by R. A. Pense and Jean W. Pressler	463
Kuwait, Kuwait-Saudi Arabia Neutral Zone, and Saudi Arabia, by David A. Carleton	473
Liberia, by Walter C. Woodmansee	483
Libya, by Walter C. Woodmansee	489

Digitized by Google

	Page
Malaysia, by A. F. Grube	497
Mexico, by Burton E. Ashley	507
Morocco, by Henry E. Stipp	517
Netherlands, by Columbus R. Gentile	525
New Zealand, by John A. Stock	541
Nigeria, by David A. Carleton	551
Norway, by F. L. Klinger	559
Pakistan, by Charles L. Kimbell	573
Peru, by Robert A. Whitman	581
Philippines, by Arnold M. Lansche, R. A. Pense, and K. P. Wang	593
Poland, by Bernadette Michalski	603
Portugal, by F. L. Klinger	609
Rumania, by Joseph B. Huvos and Roman V. Sondermayer	619
Sierra Leone, by E. Shekarchi	625
South Africa, Republic of, by Walter C. Woodmansee	631
South-West Africa, Territory of, by Walter C. Woodmansee	655
Spain, by F. L. Klinger	663
Sweden, by F. L. Klinger and Bernadette Michalski	679
Taiwan, by R. A. Pense	697
Thailand, by A. F. Grube	705
Tunisia, by Eugene R. Slatick	713
Turkey, by E. Shekarchi	719
U.S.S.R., by V. V. Strishkov	729
United Arab Republic, by Henry E. Stipp	769
United Kingdom, by Columbus R. Gentile and Edgar L. McGinnis	775
Venezuela, by Gordon W. Koelling	791
Yugoslavia, by Roman V. Sondermayer	803
Zambia, by E. Shekarchi	815
Islands of the Caribbean (Bahamas, Barbados, Bermuda, Cuba, Dominican Republic, Guadeloupe, Haiti, Jamaica, Martinique, Netherlands Antilles, Trinidad and Tobago), by Burton E. Ashley	823
Central American Areas (British Honduras, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama), by Burton E. Ashley	843
Other South American Areas (Ecuador, French Guiana, Guyana, Paraguay, Surinam, Uruguay), by Burton E. Ashley and F. W. Wessel	859
Other European Countries (Albania, Denmark (including Greenland), Iceland, Switzerland), by Joseph B. Huvos, Bernadette Michalski, and Roman Sondermayer	873
Other African Areas (Botswana, Burundi, Cameroon, Central African Republic, Chad, Congo (Brazzaville), Dahomey, Ethiopia, Fernando Po, French Territory of the Afars and Issas, Gambia, Guinea, Ivory Coast, Lesotho, Malagasy Republic, Malawi, Mali, Mauritania, Niger, Rio Muni, Rwanda, Senegal, Somali Republic, Southern Rhodesia, Spanish Sahara, Sudan, Swaziland, Togo, Upper Volta), by Henry E. Stipp and Eugene R. Slatick	891

Digitized by Google

Page

Other Near East Areas (Bahrain, Jordan, Lebanon, Muscat and Oman, Qatar, Southern Yemen, Syrian Arab Republic, Trucial States, Yemen), by David A. Carleton, E. Shekarchi, Eugene R. Slatick, and Walter C. Woodmansee ---------- 935

Other Far Eastern and South Asian Areas (Afghanistan, Brunei, Cambodia, Ceylon, Hong Kong, Laos, Mongolia, Singapore, North Vietnam, South Vietnam), by Staff, Division of International Activities ---------- 953

Other South Pacific Islands (British Solomon Islands, Christmas Island, Fiji Islands, Nauru and Ocean Island, New Caledonia, New Hebrides, Papua and New Guinea), by John A. Stock ----- 971

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Minerals in the World Economy

By Edgar J. Gealy [1] and C. L. Kimbell [2]

The rising trend in the world use of mineral commodities continued in 1968. Production of almost all minerals moved upward, many to record high levels. Indicative of the rapid expansion of demand for minerals was the record set by the global steel industry. Beginning about 1946, the modestly rising world output of steel turned sharply upward and has sustained the new and rapid growth rate almost consistently ever since. In 1968, world steel output reached 528 million metric tons, over 35 million tons larger than in 1967.

The increase in this single year approached the total steel production of West Germany, the fourth largest world producer. The annual increase in 1968 was considerably greater than the yearly average recorded for the previous 5 years. The impact of such an increase on world mineral resources can be judged by translating the 35 million tons of steel into crude mineral terms. This quantity of steel represents roughly a similar tonnage of coal for coke, about 55 million tons of iron ore, 6 million tons of limestone, and perhaps 2 million tons of alloy metal ores. In addition, the increased production involved an incalculable quantity of energy absorbed in the refining, transforming, and transporting phases of the industry. While steel serves as a prime example, virtually all major mineral commodities have followed a similar pattern of growth—some, such as aluminum and petroleum, more pronounced than others.

During 1968, the problems relating to the production and distribution of crude petroleum that resulted from the Arab-Israeli war in 1967 were fairly well adjusted. However, continued closure of the Suez Canal meant that crude oil supplies to Europe were forced prematurely into other transportation channels. The move to larger tankers, underway before Suez was closed, was accelerated and the Middle East crude pipelines terminating on the Mediterranean were used to near capacity. A further complication to European oil supply was the Biafran secession which sharply reduced production in Nigeria during 1968. Toward yearend, there were indications that Nigerian production was moving upward again.

World trade flows in crude petroleum have shown a fairly stable pattern over the past few years among the three major importing areas with the greatest shift coming in the growth of the Japanese market as shown in the following tabulation:

Importing area	Share of total (percent)		
	1966	1967	1968
West Europe	50.1	50.5	50.3
United States	15.7	14.6	14.5
Japan	12.1	13.5	15.0
Other	22.1	21.4	20.2
Total	100.0	100.0	100.0

Source: Statistical Review of the World Petroleum Industry for 1966, 1967, and 1968. The British Petroleum Company, Ltd.

On the supply side, the changes in the source of crude oil moved in trade have been somewhat more significant with only the Middle East demonstrating stability despite the problems of war and transportation within that area, as shown in the following tabulation:

[1] Assistant to the Chief, Division of International Activities.
[2] Physical scientist, Division of International Activities.

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Exporting area	Share of total (percent)		
	1966	1967	1968
Middle East	50.8	51.0	51.0
Caribbean	19.5	18.5	16.7
North Africa	12.7	13.2	17.1
U.S.S.R.	6.3	6.0	5.5
Other	10.7	11.3	9.7
Total	100.0	100.0	100.0

Source: Statistical Review of the World Petroleum Industry for 1966, 1967, and 1968. The British Petroleum Company, Ltd.

The Vietnam war continued to impose its abnormally high demand upon mineral materials and the United Kingdom embargo upon Southern Rhodesian trade persisted throughout 1968. The resilience of the world mineral industry was documented by the ability to adjust to these events and to continue to respond to increased demand with increased output. In total, the world in 1968 did not suffer significantly from major shortages of mineral supplies.

Consonant with the growth in the world use of minerals has been an increase in exploration and development activities. In the exploration field, new techniques are constantly being sought, devised and put to use. In 1968 the United States, in appreciation of the potential for resource development offered by earth-circling satellites, was looking forward to the development of the Earth Resources Observation Satellite (EROS) program. Essentially, the proposed satellite would not be devoted specifically to mineral resources but to the vast array of natural resources. Photographs from space have already indicated the possibilities for discovering areas of potential mineral deposition. The aim of an EROS program would be to use the newer techniques such as infrared photographs at specific angles to the earth so that resource interpretations can be more productive and meaningful.

Noteworthy additions to mineral resources in 1968 included phosphate deposits in India, copper deposits in Panama, and the extension of the oil discoveries on the north slope in Alaska. While these were spectacular, they are difficult to pinpoint exactly in a time frame. Furthermore, over the years, the more newsworthy additions to economic mineral resources probably are not nearly as significant to the world resource posture as the cumulative effect of the small, almost unnoticed additions and discoveries which occur on a day-to-day basis. However, the proving of the billions of barrels of oil in Alaska was of such magnitude as to affect the policies and plans of countries and companies interested in petroleum all around the world.

The heavy demands for mineral materials, the increased capital investment needed, the rising cost of finance, and the general problems of inflation apparently began to have an impact on world mineral prices in 1968. The cost of delivered petroleum, particularly to West Europe, was significantly higher after the adjustment to the Middle East war. Relocations of supply to higher cost crude oil, longer transport routes, and rescheduling of refinery production all contributed to the increased cost.

Among the nonfuel minerals, world prices are always moving in different directions on a commodity-by-commodity basis. However, in 1968, the pattern of change appeared to be definitively upward. Essentially this was a continuation and a firming of the trend evidenced in the past several years. Among the major industrial minerals, those exhibiting the greatest price increase during the 10-year period to 1968 were copper and phosphate rock; iron ore and insulating materials were among the few commodities which declined in price during the period. With the exception of petroleum, prices of other mineral fuels were relatively stable through 1968.

Although 1968 was a relatively quiet year in terms of political and policy changes on the part of nations and international organizations, there were some events and changes of worldwide importance. The United Nations continued to sponsor research for mineral anomalies in the developing countries. These activities have been responsible for the uncovering of several new mineral finds, perhaps the most viable in an economic sense being the molybdenum-bearing copper deposits in Panama already mentioned.

Several international organizations, including the United Nations, GATT (The General Agreement on Tariffs and Trade), and OECD (Organization for Economic Cooperation and Development), were involved in examining some form of preferential tariff scheme and other means to give less developed countries better access to developed country markets in order to stimulate their economic growth and development. Although tariff preferences would

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probably be more effective in manufactured and semimanufactured commodities, primary materials—mineral as well as agricultural—make up a large part of the trade flow from less developed to developed countries. Success of any such preferential scheme, if adopted, is certain to have a significant impact on mineral and mineral-based commodity trade. The magnitude of success can be envisioned when it is recognized that in 1938 some 30 countries produced rolled steel and that by 1968 this number had doubled and new plants, planned or in construction, were raising the number practically every year. Other new mineral processing facilities, such as petroleum refineries, petrochemical plants, and aluminum reduction plants, installed around the world undoubtedly will provide an industrial base for the further economic growth of developing countries.

Some national policies shifted during 1968. Indonesia significantly eased the restrictions of several years standing on the entry of foreign investment into resource development. The early response, mostly aimed at nickel and petroleum, was encouraging. Peru, after apparently settling its controversy with International Petroleum Company (IPC) with the Act of Talara, had a change of government. The new government voided the Act and expropriated the company's oilfields and refinery. Australia moved significantly in the expanding field of offshore mineral development by unifying the law of the Commonwealth and the various States regarding the jurisdiction and administration of offshore oil areas. Legal problems covering jurisdiction of offshore areas, potentially rich in natural gas, between West Germany, Denmark, and the Netherlands were carried to the World Court in The Hague.

There appeared to be general continuing movements toward centralization or nationalization within the world mineral industry. These movements tend to accomplish a close control within a national or supranational framework. Among those countries furthering nationalization were Algeria which tightened control of its oil and gas industry, Peru which expropriated a large part of its petroleum industry, and southern Rhodesia which nationalized its construction materials industry. Mergers were planned or consummated, primarily within the steel industry, in the European Economic Community (EEC), in Japan, and in the United States.

PRODUCTION

The value of world crude mineral production in 1968 was estimated at roughly $84,000 million, an increase of about $5,000 million over the 1967 level.[3] As in previous years, comprehensive statistics on the value added by processing of these materials in mineral industry plants are wholly lacking, and can be estimated only very roughly, but presumably was of the order of $210,000 million or more.

PRODUCTION INDEX PATTERNS

United Nations production indexes for various sectors of the world's mineral industry (excluding Communist Asia) and for major groups of countries are presented in table 1. This series indicates that in 1968, the mineral industry as a whole, (extractive industries together with the base-metals processing industries) although recording gains over past performance throughout the year, did not keep pace with the growth of overall industrial production. Among the mineral industry sectors listed, only the chemical, petroleum, and coal products sector registered a greater gain than that for overall industrial production. On a quarterly basis in 1968, producers of nonmetallic mineral products, although registering a greater gain than that recorded for overall industrial production, ended the year about on a par with total industrial output because their gains were from a lower base point.

Considering the three major elements of the extractive industry (metals, coal, and petroleum including natural gas), the pattern of growth of each, while contributing

[3] Estimates based on extrapolation of data for 1963 compiled for and published in Annales des Mines, No. 4, 1966, pp. 7–98, to which has been added a factor equal to 11 percent of the total reported to allow for commodities not included in the Annales des Mines study. Extrapolation is based on United Nations indexes of extractive mineral industry production presented in table 1 of this chapter, but allows for production by countries not covered by the United Nations index. On this basis, figures for previous years, in thousand million U.S. dollars, are—1963, 65; 1964, 69; 1965, 73; 1966, 76; 1967 (revised from previous edition of this chapter), 79.

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to a general gradual increase for the extractive sector as a whole, varied considerably. Metals started the year on a par with the 1967 average, advanced sharply in the second quarter, and varied but little in the remaining half year. Coal, following the traditional pattern made its best showing in the first and last quarters, with the low point in the third quarter. It should be noted in this case, that although the annual index for 1968 output was identical with that for 1967, quarterly figures were for most periods higher than in the corresponding period of 1967. Crude petroleum and natural gas recorded a sharp increase in the first quarter with respect to the 1967 average, remained stable in the second quarter, and edged marginally upward in the final half year. From a regional viewpoint, the less industrialized countries and the countries of Communist Europe showed the most pronounced gains in mineral extraction, but as with other index statistics, the reader should be cautioned to consider the base (1963) from which these growth indexes have been calculated, when weighing performance of one area of the world against that of another.

Considering the mineral processing sectors, world base metals plants showed a sharp gain in the first quarter of 1968 relative to the last quarter of 1967, then edged up slightly in the second quarter, fell sharply in the third quarter to the 131 point level of the last quarter of 1967 and finally recovered noticably in the fourth quarter of 1968. In contrast, nonmetallic mineral products and chemicals, petroleum and coal products, after a poor first quarter, advanced sharply in the second quarter and thereafter generally edged upward only slightly through yearend.

Within the processing sectors, the growth rate of non-Communist industrialized countries, although slower than that in the less industrialized nations and the European Communist nations, was much closer to the world average than in the case of the extractive industries.

QUANTITATIVE COMMODITY OUTPUT

Table 2 summarizes total world output of a number of mineral commodities for 1964–68, while table 3 gives the regional distribution of 1968 output of these commodities in terms of percent of world total. Tables within the statistical summary of this chapter provide detailed figures on distribution of output of selected major commodities by major producers for the years 1964–68.

Nonfuel Mineral Commodities.—Of the 36 metallic mineral commodities listed in table 2 for which the Bureau of Mines records world output, all but four show a greater output in 1968 than in 1967. On a percentage basis, beryl (up 31 percent), uranium (up 19 percent), and vanadium (up 14 percent), showed the greatest gains, but from the viewpoint of total mineral commodity output value, the 9-percent increase in iron ore production, the 7-percent increase in ingot steel output, and the 12-percent increase in smelter copper production were among the most prominent. The average increase between 1967 and 1968 for the metal commodities listed was 6 percent.

Among the 22 industrial nonmetal mineral commodities for which world output data are tabulated in table 2, 17 showed gains in 1968 output over that of 1967, and the average increase was 5 percent. Most notable among the products showing increases were graphite and strontium from the viewpoint of percent (up 22 percent each), while cement, salt, and sulfur were most significant from the viewpoint of value owing to the vast quantities produced, and thus the quantity of the increase. Among commodities for which declines were recorded, industrial diamond and diatomite were most notable.

Tables 21 to 34 respectively of this chapter give details on output of major nonfuel mineral commodities by major producers for 1964–68.

Mineral Fuel Commodities.—Preliminary data indicate that world production of energy commodities in 1968 reached a new high as output of all major crude mineral fuels reached levels higher than those of 1967. In terms of standard coal equivalent (SCE) total commercial energy[4] production was on the order of 6,150 million metric tons SCE, compared with a reported[5] 5,756 million metric tons in 1967 and 5,624 million metric tons in 1966.

[4] Excludes wood, charcoal, bagasse, animal dung, and other minor fuels, although such fuels are used as commercial fuels in some isolated instances.

[5] United Nations. World Energy Supplies 1964–67. Statistical Papers, ser. J, No. 12, New York, 1969, p. 14.

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Output of crude oil, natural gas and hydroelectric/nuclear electric/geothermal power all increased to new record highs, while coal output, although higher than in 1967, did not reach the 1966 peak. Crude oil, for the second year, ranked as the leading source of energy on a percentage basis, as shown in the following tabulation:

Energy source	Percent of total energy production		
	1966 [1]	1967 [1]	1968 [2]
Coal (including lignite)	41.0	38.3	36.8
Petroleum	38.6	40.4	41.6
Natural gas	18.1	19.0	19.4
Hydro, geothermal, and nuclear electricity	2.3	2.3	2.2
Total	100.0	100.0	100.0

[1] Source: United Nations. World Energy Supplies 1964–67, Statistical Papers, ser. J, No. 12, New York, 1969, p. 14.
[2] Estimate, based on extrapolation of United Nations data for 1967 using world production data for listed commodities for 1968 reported to and published by the U.S. Bureau of Mines.

Geographical distribution of output of coal, oil, and natural gas for 1964–68 is given by major producers in tables 35–37 of this chapter.

TRADE

GENERAL TRENDS

The aggregate value of world mineral commodity trade in 1968 undoubtedly exceeded the estimated $56,370 million level attained in 1967. The less industrialized nations continued to expand output of minerals for processing in developed countries at a greater rate than the developing countries expanded internal production of such materials. The 1968 aggregate value of mineral commodities traded was increased not only by this expansion of crude and partly processed mineral commodity movement from the less industrialized to the developed countries, but also by growth in the reverse movement—mineral commodity products from developed nations to the less industrialized regions of the world. In addition, the increase in unit prices of a number of commodities coupled with greater volume movement undoubtedly further swelled the 1968 value of mineral commodity trade. Unfortunately, however, reasonably reliable quantification of the aggregate value for 1968 is impossible at this time, owing to far-from-complete reporting on 1968 trade by a number of major countries.

In 1967, the most recent year for which complete trade returns are available on a worldwide basis, the mineral commodities in aggregate accounted for a slightly larger share of total commodity trade than in 1966, and, with an estimated total value of $56,370 million, exceeded the 1966 total value by about 6.4 percent. In spite of the large variations in the rates of gain of total mineral trade from year to year, the share of total commodity trade accounted for by minerals over the 1963–67 period has been relatively stable as shown in the following tabulation:

Year	Estimated value of mineral commodities traded [1] (million dollars)	Increase relative to previous year (percent)	Mineral commodities' share of all commodities traded (percent)
1963	r 40,260	18.6	26.2
1964	r 45,690	13.5	26.5
1965	r 49,860	9.1	26.8
1966	r 53,000	6.3	26.1
1967	56,370	6.4	26.3

r Revised.
[1] Value estimated from data reported in table 4, to which has been added a factor for mineral commodities not included in that table. The factor added is based on comparison of complete mineral trade value returns for selected countries with data given for these countries in the source for table 4 for the selected commodity groups included therein. Such a comparison indicates that the recorded mineral commodities represent about 78 percent of total mineral commodity trade.

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COMMODITY GROUP TRADE PATTERNS

Although mineral commodities continued to account for about the same share of total commodity trade in 1967 that they have in previous years, there were fluctuations in the proportion of total mineral commodity trade accounted for by each of the major groups of mineral commodities. The pattern of a more rapid growth in the value of metals traded than in the value of mineral fuels and metals in ores, concentrates and scrap traded which had prevailed during 1963–66 was broken in 1967. As shown in the following tabulation, the share of the total accounted for by fuels moved upward, whereas metals trade declined.

Year	Share of total listed [1] mineral commodity trade (percent)		
	Metal ores, concentrates and scrap	Metals	Mineral fuels
1963	11.6	38.4	50.0
1964	12.2	40.1	47.7
1965	11.8	42.1	46.1
1966	11.5	42.8	45.7
1967	11.4	41.7	46.9

[1] As given in table 4 of this chapter.

The principal factor in this change was the Near East crisis of June 1967, with attendant higher oil prices stemming from, first, substitution of higher unit price oils during that time when supplies from the Near East were almost wholly shut off, and second, higher average prices for all oil following resumption of Near East oil deliveries which in turn was accompanied by an increase in transport costs for Near East oil resulting primarily from the continued denial of the Suez Canal route.

Advancing copper prices, which contributed significantly to the total increase in the dollar value of metal trade, were somewhat offset by restrictions on copper movement owing to the tight supply situation resulting from the U.S. copper strike. Thus the aggregate value of metals trade increased only modestly, and the share of total recorded mineral commodity trade accounted for by metals declined.

As has been the case since 1964, the share of total mineral commodity trade attributed to metal ores, concentrates and scrap declined again in 1967, reflecting the continuing trend toward shipment of processed metals rather than ores, as well as possibly increased domestic reprocessing of scrap in nations when heretofore exported a greater proportion of scrap for processing elsewhere.

REGIONAL TRADE PATTERNS

Data on world trade in major commodities (metal ores, concentrates and scrap, ingots and semimanufactures of metals, and mineral fuels) are presented in tables 4 and 5, the former showing world export and import totals by commodity group for 1964–67 and by continental area for 1967 alone, the latter showing distribution of total major mineral commodity trade by trading partner areas and/or countries.

Trends in the proportional distribution of trade in major mineral commodities between the industrialized nations and less developed countries shown in table 6 for 1965–67 are worthy of note. During 1965–67, industrialized nations provided a constantly declining proportion of total major mineral commodity exports despite the fact that the aggregate value of exports from these countries has increased. The dollar value increase in these exports has been distributed between exports to other industrial countries and to the less developed countries. Following the same pattern, the decline in percentage of total exports of the industrialized countries is reflected in both the percentage of total destined for other developed countries and that destined for the less developed countries.

In the case of imports during 1965–67, the industrialized countries have taken a greater dollar value as well as a proportionally greater share of total major mineral commodity imports in each year, and each of the groups of countries—industrialized and less developed—have contributed both to the dollar value and percentage gains.

In the case of the less developed nations, their contributions of exports to total trade in major mineral commodities during 1965–67 has constantly increased on both a value and percentage basis. On a dollar basis, this growth is distributed between developed and less developed nations. On a percentage basis, however, the less developed countries have shipped a steadily greater share of the total to the developed countries, while their exports to other less developed countries have accounted for a smaller part of the total.

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The countries of the European Economic Community (EEC) in 1967 accounted for 21 percent of total world exports of major mineral commodities and 28 percent of the world imports of these commodities (those listed in table 4). The value of EEC mineral commodity imports exceeded that of exports by $3,300 million. Of the total value of major mineral commodity trade attributed to the EEC, $4,550 million was for commodities traded between the six member states (50 percent of total regional exports and 37 percent of total regional imports), while $7,800 million was for imports from non-EEC countries and $4,500 million was for exports to non-EEC nations. The $3,300 million aggregate negative trade balance of the EEC in major mineral commodities in 1967 was approximately $130 million greater than the negative balance in 1966, but this increase was equal to only 16 percent of the increase registered between 1965 and 1966.

The European Free Trade Association (EFTA) member states in 1967 accounted for 8 percent of total world exports and 14 percent of total world imports of major mineral commodities, recording the expenditure of $2,885 million more for imports than was obtained for exports of commodities in this group. Intraregional major mineral commodity trade was valued at $952 million in 1967 ($928 million in 1966), while imports from outside EFTA totaled $5,338 million ($5,382 million in 1966) and exports to non-EFTA countries totaled $2,453 million ($2,382 million in 1966). The aggregate negative trade balance of the EFTA in major mineral commodities was reduced from $3,000 million in 1966 to $2,885 million in 1967.

The Communist nations of Europe (excluding Yugoslavia) in 1967 recorded trade in major mineral commodities that represented about 11 percent of total world exports and 9 percent of total world imports of these materials, and thus had an aggregate positive trade balance for these items of $1,255 million, only slightly less than that of the previous year. As in the past, however, the greater part of the total major mineral commodity trade of these countries again was between nations of the group rather than with outside countries. Almost 60 percent of total recorded exports of those countries were to other European Communist countries and almost 80 percent of their imports of major mineral commodities were obtained from other nations within this economic unit. Major mineral commodity exports to other countries increased 2.3 percent in value from $1,975 million in 1966 to $2,020 million in 1967, while imports from other countries increased 8.5 percent to $765 million. Thus, the region's trade balance in these commodities, although remaining clearly positive, was eroded owing to the more rapid rise in the import rate.

Japan, as a result of its position as the only major industrialized country of Asia and its prominent position as a processor of mineral commodities both for domestic use and for export, is treated separately from other Asian countries. This single nation in 1967 accounted for 9 percent of total world imports and 3.2 percent of total world exports of major mineral commodities (6.7 percent and 3.5 percent, respectively in 1966). In terms of both actual value and percentage share of the world total, the nation's major mineral trade balance position worsened relative to that of 1966, as annual imports increased 43 percent while exports fell 2.4 percent. The negative trade balance in major mineral commodities in 1967 stood at $2,557 million, compared with $1,328 million in 1966 and $835 million in 1965.

Among the remaining industrialized nations of the world, the United States, Canada, the Republic of South Africa and the nations of non-Communist Europe not in EEC or EFTA (including Yugoslavia) all showed increases in 1967 both in total value of major mineral commodity exports and in percentage of total world exports of these commodities with respect to their 1966 performance, while Australia and New Zealand (jointly) recorded declines, both in value and share of total. All of the above-mentioned industrialized nations showed increases in the dollar value of their mineral imports in 1967 with respect to 1966, but the increases were all less than the total world growth in import value, thus all accounted for slightly lower shares of the total in 1967.

Considering the world's less developed countries in groups on a continental basis, all showed dollar increases in the value of mineral exports, but only those of the Near East and Latin America showed percentage gains exceeding the total world gain, thus although the nations of Africa and Asia showed an improvement from the viewpoint

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of dollars, their share of the world total fell. (In Asia, a precipitous decline in dollar value of exports by the Communist nations was wholly responsible for the percentage decline; non-Communist less developed countries here showed a percentage increase on a par with that for the world average).

Using the same continental groups of less developed countries in considering imports, Asia and Africa showed increases both in value and percentage of world total relative to 1966 performance for the major mineral commodities. The Near East imported a greater dollar value of such materials but accounted for a smaller share of total world imports, and Latin America showed a lower level of receipts on the basis of both dollar value and share of total.

In connection with the less developed countries, it should be noted that in Latin America, the first area of less developed countries to establish wholly internal regional trade associations (the Latin American Free Trade Association—LAFTA, and the Central American Common Market—CACM), there has been a trend in major mineral commodity trade toward greater movement of materials of this type within the area, but the relationship between this shift and these organizations has not been proven. Although major mineral commodity trade within the area remains a relatively small proportion of the region's total trade, it has increased significantly from 3.7 percent in 1965 to 7.8 percent in 1966 and 8.0 percent in 1967.

A number of less developed countries, chiefly former French colonial areas, remain linked to the European Economic Community as associate members, and in all likelihood this tie has influenced their trade patterns.

CONSUMPTION

NONFUEL MINERAL COMMODITIES

World consumption of most nonfuel mineral commodities, both metals and nonmetals, again advanced in 1968 on a tonnage basis, but as in 1967, gains on a per capita basis were more modest and less universally consistent. Consumption of iron ore apparently made a sharp recovery from its 1967 slump, as steel output rose to a new high of nearly 528 million tons. Even the continuing trend toward higher grade iron ores and continued growth in scrap use in some countries evidently failed to provide sufficient iron in the raw material feed; thus gross ore production (and presumably consumption as well) turned upward.

In the case of major nonferrous metals, for which consumption data appear in table 7, the end of the major U.S. copper strike led to increased copper output which moved quickly into consumer markets, swelling consumption to a level less than 0.3 percent below the historical record high of 1966, and 4.9 percent over the 1967 level. Of even greater significance however, was the 12.9-percent, 933,000-ton increase in aluminum consumption in 1968. On a tonnage basis, this was the largest annual increase ever recorded by the aluminum industry, ranking ahead of the previous maximum increase of 630,400 tons recorded between 1958 and 1959, and on a percentage basis, the greatest annual increase during the 1958–68 period.

While complete world data on nonmetallic mineral consumption are not available, it is certain that use of most major commodities—limestone, cement, sulfur, and fertilizer materials—advanced in 1968, although growth of fertilizer materials evidently did not come quite up to levels forecast by agricultural industry planners.

MINERAL FUEL COMMODITIES

In 1967, total world energy consumption in terms of standard coal equivalent (SCE) reached a new high of 5,611 million metric tons as shown in table 8. The balance between fuel types altered appreciably, and for the first time, liquid fuels were the leading energy source, accounting for 39.5 percent of the total (37.7 percent in 1966), while solid fuels provided 38.7 percent (41.6 percent in 1966). Gaseous hydrocarbons, also showing a substantial quantitative gain, registered a gain in their share of the total energy consumed from 18.4 percent in 1966 to 19.4 percent in 1967. Although consumption data for 1968 was not available at this writing, extrapolation of production figures for major fuels, indicates that 1968 consumption probably was of the order of 5,990 million tons SCE.

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The sharp decline in coal production and consumption in mainland China in 1967 owing to the major political disorders experienced in that year undoubtedly had a significant effect upon the world energy balance and presumably was the primary factor in reducing coal consumption below the level of oil in terms of SCE. Partly compensating for this shortfall in coal consumption was the sharp cutback in Near East oil supplies to Europe in mid-1967 as a result of the Arab-Israeli war. While new routes for oil movement avoiding the Suez Canal were put into operation almost immediately, and despite increases in oil output outside the Arab States, the Near East situation apparently had a sustaining impact on European coal production because of a slowdown in substitution of imported oil for local coal in Europe's energy market. However, despite the upturn in mainland China's production and consumption of coal in 1968 relative to 1967, it is doubtful if coal regained first place among energy sources in 1968, owing to continued more rapid growth in output (and thus of consumption) of liquid and gaseous fuels.

On a regional basis, distribution of total 1967 world energy consumption varied but little from that of 1966, with Western Europe and the Communist countries of Europe and Asia registering declines in share, North America holding essentially unchanged, and the Far East, Near East, and Africa logging increased shares of the total. More pronounced were the differences between 1966 and 1967 within each area from the viewpoint of per capita consumption. All areas listed in table 8 recorded growth in consumption on a per capita basis except for Africa and the Communist nations. In the former area, the single industrialized nation, the Republic of South Africa, showed a modest gain in per capita energy consumption, and the decline in per capita consumption in the developing countries of the continent was not the result of lower total consumption levels but rather of the more rapid increase in population than in energy consumption. In contrast, among the Communist countries, Czechoslovakia, East Germany, Hungary, and the Asian Communist countries (taken as a group in source data) all registered declines in total energy consumption as well as in per capita consumption, while Albania, Bulgaria, Poland, Rumania, and the U.S.S.R. recorded increases both in aggregate and per capita energy consumption.

INVESTMENT

Comprehensive data on world investment in mineral industry operations are not available, but partial data on investment in certain geographic areas and commodities clearly point to continued overall growth in such investments during 1968.

Table 9 summarizing steel industry investment expenditures for countries and country groups within the Organization for Economic Cooperation and Development (OECD) indicates an increase of nearly 7.5 percent in the annual investment for 1968 over 1967 levels for the listed countries, a figure about on a par with that for 1967 over 1966 and well ahead of the 5.8-percent growth between 1965 and 1966; this despite the fact that the 1968 detail is incomplete.

These steel industry investments, while leading to increased capacity, have been devoted primarily to modernization for the sake of economic rationalization in most countries. The erection of additional oxygen steel process equipment and iron ore sintering and pelletizing plants continued to receive relatively high proportions of total steel investment, not only within the OECD nations, but in other steel producing nations as well.

Within the European Coal and Steel Community (ECSC)[6] capital expenditures in the coal mining industry in 1968 totaled $277 million, up $34 million from 1967, but well below the 1954–67 annual average of $365 million. ECSC capital expenditures for brown coal briquet and low-temperature brown coal coke plants decreased from $5 million in 1967 to $4 million in 1968, while expenditures for iron mines increased $5 million to $21 million.

Table 10 summarizes non-Communist world petroleum industry capital expendi-

[6] Membership is identical to that of the EEC—Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands.

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tures and exploration expenses for 1964–67, distributed on a geographic basis. These in total increased only 6.2 percent in 1967 over those of 1966, compared with a 10-percent increase between 1965 and 1966. The geographic distribution of the total was essentially the same as in 1966, with regional percentages varying no more than 1 percent from those of the previous year. The United States was dominant, accounting for 49 percent, followed in order by Western Europe—16 percent, Other Western Hemisphere—13 percent, Far East—6 percent, and Africa and the Middle East—4 percent each (balance not specified by area). The percentage change in each of the areas, comparing 1967 figures with those for 1966, however, varied considerably from area to area. The expenditures and expenses in the United States increased 6.3 percent between 1966 and 1967 (11.3 percent between 1965 and 1966). Comparable figures for other areas for 1966 to 1967 were as follows: Other Western Hemisphere—up 5.8 percent (up 14.3 percent in the previous year), Western Europe—up 9.7 percent (up 17.0 percent between 1965 and 1966), Africa—up 10.2 percent (down 9.3 percent between 1965 and 1966), Middle East—down 7.7 percent (down 1.5 percent between 1965 and 1966), Far East—up 18.0 percent (no change from 1965 to 1966).

Table 11 distributes the same total of non-Communist world petroleum industry capital expenditures and exploration expenses during 1964–67 by industrial sector. As in the case of the geographic distribution, there was little difference between 1966 and 1967 in the percentage distribution of the total outlay of funds on a sector by sector basis. Production accounted for 36 percent of the total in each year, pipelines for 5 percent, marine facilities for 8 percent, and chemical plants for 9 percent. Refinery construction, which absorbed 17 percent of the 1966 total, accounted for only 15 percent of the larger 1967 total, while the share of total accounted for by marketing advanced from 15 percent to 16 percent.

Table 12 details U.S. direct investment in mining, smelting and petroleum industry activities in foreign areas, together with earnings and income from these investments for 1966 and 1967, the most recent years for which such data are available. The growth rate of this foreign investment in mining and smelting between 1966 and 1967 was 11.5 percent, compared with 9.2 percent between 1965 and 1966; corresponding figures for petroleum industry investment were 7.4 percent between 1966 and 1967 and 6.3 percent between 1965 and 1966. Although data for 1968 were not available at this writing, it is expected that mandatory controls on U.S. foreign investment that were implemented January 1, 1968, undoubtedly led to a sharp reduction in the rate of increase, which had continued to move upward during 1967 despite U.S. Government requests for voluntary limitations on such investment.

On a regional basis, for mining and smelting, over 50 percent of the increase was in Canada, which in 1967 accounted for nearly 49 percent of the total investment, while 27 percent of the increase was in Latin America and other Western Hemisphere (38 percent of the 1967 total) and 14 percent of the increase was in Australia (7 percent of the 1967 total). Petroleum investment by region increased 35 percent in Europe (which accounted for 25 percent of the 1967 investment total), 17.5 percent in Canada (which accounted for 22 percent of the 1967 investment total), and 18 percent in international shipping (which accounted for 7 percent of the total investment). In Latin America and other Western Hemisphere (excluding Canada), which accounted for 20.1 percent of total U.S. foreign investment in oil in 1967, the increase between 1966 and 1967 was only 2.2 percent of the total increase in oil industry investment.

Firm value data on expenditures in mineral industry facilities in the Communist nations are not available, but available information on investment increases in terms of percentages of previous levels for the U.S.S.R. indicates that, although there is variation between sectors of the mineral industry, the overall trend in 1968 remained toward acceleration of growth within this broad sector of the economy.

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TRANSPORTATION

MARINE TRANSPORT

Three major classes of vessels are engaged in transporting mineral commodities, oil tankers, bulk carriers, and freighters. Table 13 summarizes the world's total merchant fleet in terms of number of vessels and tonnage listing these classes separately and reflecting to some extent the involvement of mineral commodities in world shipping. It should be pointed out that in the case of each of these major classes, certainly not all of the craft listed are engaged in transporting mineral commodities. The world tanker fleet is unquestionably most heavily devoted to petroleum trade, but also includes vessels moving whale oil and other nonmineral liquid materials. Bulk carriers, engaged from the mineral industry viewpoint chiefly in movement of metal ores, cement, fertilizer materials, and other industrial nonmetals, are used to a considerable extent in movement of bulk agricultural products. The proportional involvement of freighters in mineral commodity movements is much less than is that of oil tankers and bulk carriers, nonetheless their contribution to mineral commodity movement in terms of tonnage, particularly of such items as metal ingots and semimanufactures, is considerable. While data are not available on a worldwide basis on tonnage of mineral commodities moved as a percent of tonnage of all commodities moved, it is perhaps significant that in fiscal 1967, 73.7 percent by weight of all goods transiting the Panama Canal were mineral commodities.

In addition to tankers, bulk carriers, and freighters, combination passenger and cargo ships, included among "other vessels" in table 13, undoubtedly move minor quantities of mineral commodities, but their contribution is regarded as insignificant in terms of total mineral commodity movement.

Pressures to reduce the cost of ocean transport, to move increasing quantities of materials over greater distances, to move products in forms heretofore not moved commonly by ship, and to move materials from areas heretofore inaccessible to vessels of any size have led to changes in the nature of the world's merchant fleet and the harbors for this fleet, which, if not started in 1968, certainly were evidenced strongly during the year.

Notable changes in vessels included the increase in size of tankers and bulk carriers, the development of bulk carriers capable of moving oil, ores and concentrates, and/or bulk agricultural products in triangular trade rather than continuing the overall more costly, time-honored practice of using separate vessels which are forced to run in ballast for half of their mileage traveled, and the development of special refrigerated pressure-tank ships for natural gas movement. A specific change in vessels, undertaken in 1968, was of the modification of the Humble Oil Company's large tanker, the S.S. Manhattan, to a configuration that hopefully will permit this ship to batter its way through the ice north of Canada on a route to the Prudhoe Bay oil area of Alaska. If 1969 testing proves the feasibility of this scheme, construction of additional large tankers equipped for ice breaking is expected, in order that this new oil area can be economically exploited without development of a high-cost pipeline from the field to refining and market areas.

In the area of development of loading and unloading facilities, specific changes in 1968 were too numerous for specific mention here, but throughout the world, projects of harbor development—deepening, addition of modern, high volume loading and unloading equipment—and of construction of offshore loading facilities where no harbor can be developed continued at record rates.

Tankers.—Expansion of the world petroleum tanker fleet continued in 1968 at a pace faster than that of the total world merchant fleet. Data in table 13 indicate a 4.1-percent increase in number of such vessels, an 8.9-percent increase in aggregate gross tonnage, and an 11.0-percent increase in deadweight tonnage as of December 31, 1968, relative to the levels of December 31, 1967. These figures may be compared with percentage increases of 3.0 percent in numbers, 7.4 percent in gross tonnage, and 9.1 percent in deadweight tonnage for all types of merchant ships.

The average gross tonnage of tankers in service increased from 17,595 tons to 18,393 tons, while the average deadweight tonnage advanced from 28,220 tons to

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30,073 tons[7] between yearend 1967 and yearend 1968, reflecting the addition to the fleet of tankers of larger size than those being taken out of service. The shift toward larger tankers is more dramatic when examined in detail by various size groups, and is particularly pronounced when data for existing vessels are compared with that for planned new construction. Table 14 provides such a comparison between vessels in service at yearend 1966, vessels in service at yearend 1968, and those underway and on order at yearend 1968.

Assuming that all additions under way and on order at yearend 1968 are completed and in service by yearend 1970, and discounting reductions in total deadweight tonnage owing to losses, scrapping and other deletions from the roster of vessels that were in service at yearend 1968 (a figure which cannot be estimated with any certainty at present), at least 23 percent of the total tonnage will be in tankers of 205,000 tons or more each and an additional 12 percent will be in tankers of 105,000 to 205,000 tons each, while only 34 percent will be in vessels of less than 45,0000 tons, compared with a yearend 1968 figure of 46 percent for the latter category. In actuality, the composition balance of the world's tanker fleet in 1970 will likely be more in favor of the larger sizes of vessels than the above figures indicate, owing to removal from service of the less-efficient smaller ships to the extent possible.

The rapidity of change in the world tanker fleet is reflected in an analysis of these vessels by age groups.

Only 5.4 percent of the aggregate deadweight tonnage in service at yearend 1968 was built prior to yearend 1945, 2.7 percent during 1946–50, 12.9 percent during 1950–55, 24.4 percent during 1956–60, 29.2 percent during 1961–65, and 25.3 percent was built during 1966–68.[8] The same source indicates that new building in progress and on order at yearend 1968 totaled 52.6 million deadweight tons. Assuming completion of these vessels by 1970, 70 percent or more of the 1970 fleet's total tonnage will be in vessels 10 years or less in age and half or more will be in vessels 5 years or less in age.

Distribution of the world tanker fleet at yearend 1968 by flag of registry, ranked in order of national aggregate tonnage was as follows:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	649	25,945
Norway	414	16,528
United Kingdom	424	14,498
Japan	304	11,846
United States	312	7,363
Panama	159	4,815
France	141	4,597
U.S.S.R.	322	4,398
Italy	161	3,735
Greece	151	3,312
Other	858	20,098
Total	3,895	117,135

Bulk Carriers.—Maritime Administration data (table 3) indicate that, as in the case of tankers, world bulk carrier fleet growth between yearend 1967 and yearend 1968 exceeded the level of growth of the total merchant fleet. The number of vessels increased 10.2 percent, while gross tonnage advanced 18.8 percent and deadweight tonnage moved upward by 20.7 percent. Although this class of merchant vessel includes both those moving crude minerals and concentrates, and those hauling bulk agricultural products, the increases in this segment of the world merchant fleet are to a significant extent the result of additions of large ore carriers and of large bulk carriers capable of moving ore, oil, and other bulk commodities. The latter class of vessel is not identified separately in Maritime Administration data, but other sources indicate that at yearend 1968, the aggregate deadweight tonnage of such vessels exceeded 11 million tons, and that about 7 million deadweight tons of such vessels was under construction.[9]

The economy of large ore carriers was demonstrated in a special study[10] that compared 1947 practices with those of 1968. A single 120,000 deadweight ton ore carrier was purchased in 1968 for a cost in constant dollars equal to only one-fourth

[7] Data supplied here are not comparable to that given for non-Communist world tanker fleet in previous editions of this chapter, which were obtained from other sources.

[8] British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry—1968. Baynard Press, London, 1968, p. 15. The percentages given are based on a total of 119.5 million deadweight tons, which differs slightly from Maritime Administration data in table 13.

[9] British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry—1968. Baynard Press, London, 1968, p. 14.

[10] The growth of Unit Output and its Effect on Works Planning and Management. Journal of the Iron and Steel Institute. June 1969, pp. 729–738.

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of the cost of twelve 10,000-deadweight-ton ore carriers laid down in 1947. A further saving, in operational costs, is evidenced when it is considered that the 12 vessels of 10,000 tons required a 40-man crew each, while the single 120,000-ton vessel requires a crew of only 28.

Over 77 percent of the world bulk carrier fleet at yearend 1968 was registered under the flags of seven nations in terms of deadweight tonnage as follows, ranked in order of importance:

Country	Number of vessels	Deadweight tonnage (thousand tons)
Liberia	471	14,286
Norway	337	10,010
Japan	339	8,838
United Kingdom	293	5,317
Italy	117	2,840
Sweden	94	2,600
Greece	102	2,486
Other	856	13,549
Total	2,609	59,926

Freighters.—Freighters, which constituted 57 percent of the world's merchant fleet in terms of number of vessels at yearend 1968, accounted for only 34 percent of the aggregate gross tonnage and 32 percent of the aggregate deadweight tonnage in that year. A much smaller proportion of the total number of these vessels are engaged in moving mineral commodities than in the case of tankers and bulk carriers, and data on the actual use for these commodities are not available, nonetheless mention of this class of ships is in order as they are often the carriers of the processed mineral goods, particularly metal mill products. Unlike the bulk carriers and tankers, growth in number of vessels was small (under 1 percent), and while average gross tonnage of such vessels advanced slightly, recorded average deadweight tonnage fell; the trend toward gigantism evident in tankers and bulk carriers did not extend to these ships. Neither was there a significant upsurge in the number of such vessels.

Principal nations of registry of freighters are listed in the following tabulation in order of their share of aggregate deadweight tonnage of total world freighter fleet at yearend 1968:

Country	Number of vessels	Deadweight tonnage (thousand tons)
United States	1,468	15,511
Japan	1,037	8,212
United Kingdom	893	7,722
U.S.S.R.	955	5,980
Greece	689	5,472
Liberia	462	4,760
West Germany	693	4,569
Norway	498	3,875
Other	4,357	30,601
Total	11,052	86,702

PANAMA AND SUEZ CANALS

The world's two major international seaway canals in 1968 again played a key role in patterns of marine transport of mineral commodities. The influence of the Suez Canal however, was of a negative nature, owing to continued closure from June 1967 through yearend 1968, the result of hostilities between the United Arab Republic and Israel. This situation was undoubtedly a stimulus to already-increasing construction of supertankers too large to navigate this waterway, on the assumption that even should the canal be reopened, its continued operation would be subject to interdiction at any time. Diversion of vessels from the Suez Canal route also continued to affect transit shipping through Capetown, Republic of South Africa. Here, in the year ending June 1968, almost 1,700 additional ships (30.8 million tons) passed through the port, adding nearly $1 million to port revenues.

Fiscal 1968 data on Panama Canal transits were not available, but in fiscal 1967, over 48.5 million metric tons of mineral commodities passed through this waterway, a volume which was almost 74 percent of total goods moving through the canal on a weight basis. Of the quantity of mineral commodities transiting the Panama Canal, metal ores constituted 14 percent, metals and metal manufactures accounted for 23 percent, phosphates and nitrogen products were 8 percent, coal and coke provided 20 percent, and petroleum and petroleum products constituted 35 percent.

OCEAN FREIGHT RATES

Table 15 presents United Nations indexes of selected ocean freight rates for 1964–68, including quarterly averages for 1967 and 1968. The sharp upward trend in the

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annual average for most of these rates between 1966 and 1967 did not continue into 1968; rather on the basis of the annual average there was either a decrease or only a very modest increase in the rate in 1968. In the case of the three tanker rates listed, the second quarter of 1968 was the high within the year, but the levels attained in 1968 remained below the peaks of the third quarter of 1967—the time of the Arab-Israeli open warfare. In the case of dry cargo, rates generally showed an increase throughout 1968, while fertilizer and coal rates generally fell toward yearend.

PIPELINES

Although space does not permit more than brief comments on pipeline development throughout the world, such brief comment seems in order, at least regarding international pipelines. While no major completions of such lines were reported in 1968, work progressed on several such projects including expansion of the "Friendship" oil pipeline in the Communist countries of Europe, construction of the Iranian-Soviet Union gas pipeline, and establishment of several shorter international oil and gas lines between various European countries.

PRICES

Prices of petroleum and steel, two major mineral commodities in both national economies and international trade, vary considerably according to the individual product and the different characteristics of each as well as geographic considerations. Generally the price structure within both industries moved higher in 1968. In steel products much of the price increase was the result of an unwillingness to continue to absorb the costs of special processing, sizing, and packaging required by customers. Petroleum prices generally reflected the adjustments of the industry to the Suez Canal problem. Coincidentally, crude petroleum prices to some points east of Suez declined moderately counter to the overall trend.

Major nonferrous metal prices for 1964–68 with 1968 data on a monthly basis are presented for United States, United Kingdom, and Canadian markets in tables 16, 17, and 18. The aluminum price on all three markets advanced before midyear 1968, extending the pattern of slowly advancing prices from previous years, and reflecting the firmness of increasing demand, even in the face of the large 1968 increase in output. Despite termination of the U.S. copper strike in March, and an attendant short-lived drop in consumer cost the annual average copper price for 1968 was well above the 1967 average on all three markets, and in the case of the U.S. and Canadian markets, was at a record level, while on the London market, it was below the 1966 annual average but otherwise a record high.

Lead and zinc annual average prices for 1968 were lower than in 1967 on the U.S. and Canadian markets, and higher than in 1967 on the London market; examination of tables 16, 17, and 18 will show the varying pattern of prices for these metals during 1968 on each of the three markets.

The market price for tin generally advanced on the London market during 1968 and for the year as a whole stood higher than in 1967, but below previous annual averages. Prices in the United States, despite a sharp upturn in the last quarter, averaged for the whole year less than for all of 1967 and continued the decline in annual average price extending back to 1965.

The silver price on all three markets moved upward generally during the first 5 months, peaking in June and thereafter falling off, but the 1968 annual average price in each case was considerably above that for any previous year.

Tables 19 and 20 provide data on the level of United Nations export price indexes for mineral commodities. In 1968, the decline noted in 1967 for most of these indexes continued, departures from this pattern being noted only for metal ores, which remained on a par with those of 1967, and for nonferrous base metals, which were noticeably above those for 1967 although still below the 1966 highs. Another pattern worthy of note was the consistently higher level of the index for total minerals for developed areas compared with that for less developed areas.

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STATISTICAL SUMMARY OF WORLD PRODUCTION AND TRADE OF MAJOR COMMODITIES

The final 26 tables in this chapter (tables 21–46) extend the statistical series started in the 1963 edition and updated in the 1965 and 1967 editions. They are provided both as a supplement to other statistical data within the chapter and as a summary of international production and trade data for major commodities covered in greater detail on a commodity basis in volume I–II of the Minerals Yearbook and on a country basis in volume IV. The data presented here on production (tables 21–37) include all revisions in reported data and in estimates that were available to the authors through September 30, 1968, and therefore should be considered more reliable and up-to-date than foreign production data prepared previous to this date and published elsewhere in the 1968 Minerals Yearbook. Changes in world totals in these tables relative to data published in previous editions of the Minerals Yearbook are (1) the result of acquisition of new data and (2) due to fact that totals no longer contain estimates for countries not reported individually, but rather represent only a summation of recorded figures, both reported and estimated.

Overall world movements of nine major mineral commodities are presented in tables 38–46. It should be noted that table 38 (covering bauxite) and table 40 (covering iron ore) have been revised in format; in the version included in this chapter, import data of major recipient countries have been used as the basis for compilation, thus these tables are not as complete as the corresponding tables in previous editions. However, omissions resulting from this change are regarded as being of only minor importance.

Table 1.—United Nations indexes of world [1] mineral industry production

(1963=100)

Industry sector and geographic area	1965	1966	1967	1968	1968 by quarters			
					1st	2nd	3rd	4th
EXTRACTIVE INDUSTRIES								
Metals:								
Non-Communist world	112	115	115	120	109	123	124	122
Industrialized countries [2]	111	115	113	121	107	126	126	124
United States and Canada	114	119	115	122	98	132	133	124
Europe	107	105	107	117	115	118	111	125
European Economic Community [3]	100	97	92	96	99	93	92	98
Less industrialized countries [4]	114	115	117	118	113	117	121	120
Latin America [5]	111	118	119	120	118	119	121	121
Asia, East and Southeast [6]	113	115	119	119	110	119	127	118
Communist Europe [7]	123	135	149	162	167	162	162	160
World	114	119	122	129	122	131	132	131
Coal:								
Non-Communist world	101	98	94	93	96	92	89	92
Industrialized countries [2]	100	97	93	91	95	91	87	92
United States and Canada	111	114	117	114	115	118	116	108
Europe	97	91	85	82	87	81	76	85
European Economic Community [3]	97	91	83	80	86	76	77	83
Less industrialized countries [4]	105	109	111	113	112	112	110	118
Latin America [5]	101	106	115	NA	NA	NA	NA	NA
Asia, East and Southeast [6]	106	110	112	113	112	112	109	120
Communist Europe [7]	106	108	111	115	117	114	112	116
World	103	102	101	101	104	101	98	102
Crude petroleum and natural gas:								
Non-Communist world	112	120	128	136	134	135	138	140
Industrialized nations [2]	105	111	116	120	122	119	119	121
United States and Canada	105	110	116	119	121	118	118	119
Europe	115	119	124	133	134	125	128	142
European Economic Community [3]	114	117	122	133	135	125	129	143
Less industrialized countries [4]	121	133	143	159	150	156	163	167
Latin America [5]	107	107	114	118	118	117	119	117
Asia, East and Southeast [6]	119	132	141	156	148	153	161	163
Communist Europe [7]	121	133	145	156	158	156	155	154
World	114	123	131	140	139	139	141	143

See footnotes at end of table.

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Table 1.—United Nations indexes of world [1] mineral industry production—Continued

(1963=100)

Industry sector and geographic area	1965	1966	1967	1968	1968 by quarters			
					1st	2nd	3rd	4th
EXTRACTIVE INDUSTRIES—Continued								
Total extractive industry:								
Non-Communist world	110	115	118	125	121	124	125	128
Industrialized countries [2]	106	109	111	115	113	115	115	117
United States and Canada	108	113	117	120	117	122	122	120
Europe	104	101	99	103	104	100	99	109
European Economic Community [3]	104	102	99	105	108	98	103	111
Less industrialized countries [4]	119	128	135	147	139	146	150	153
Latin America [5]	108	110	115	118	117	117	119	118
Asia, East and Southeast [6]	118	128	136	149	141	148	153	155
Communist Europe [7]	115	123	132	140	143	141	139	138
World	112	117	122	129	127	129	129	131
PROCESSING INDUSTRIES								
Base metals:								
Non-Communist world	120	124	128	132	133	137	126	134
Industrialized countries [2]	121	124	128	132	134	137	124	133
United States and Canada	121	126	117	122	128	135	110	115
Europe	119	117	118	131	130	128	127	141
European Economic Community [3]	117	116	119	133	132	128	131	144
Less industrialized countries [4]	117	125	125	138	127	133	143	147
Latin America [5]	120	124	125	140	128	133	148	152
Asia, East and Southeast [6]	113	126	128	137	131	133	139	145
Communist Europe [7]	117	127	136	145	148	146	144	144
World	119	125	127	136	138	139	131	137
Nonmetallic mineral products:								
Non-Communist world	116	121	123	131	115	134	138	137
Industrialized countries [2]	116	120	122	130	113	133	137	136
United States and Canada	114	120	118	124	106	127	134	129
Europe	116	119	121	129	111	133	136	135
European Economic Community [3]	112	115	116	125	104	129	136	132
Less industrialized countries [4]	118	125	133	141	133	143	142	148
Latin America [5]	115	124	132	142	134	143	144	148
Asia, East and Southeast [6]	120	124	135	141	134	142	139	149
Communist Europe [7]	119	131	143	154	159	155	152	152
World	117	125	131	140	132	142	143	143
Chemicals, petroleum, and coal products:								
Non-Communist world	119	130	139	153	148	152	153	161
Industrialized countries [2]	119	131	140	154	149	153	154	162
United States and Canada	115	127	133	144	139	144	144	149
Europe	123	135	145	163	159	159	161	174
European Economic Community [3]	125	138	149	170	165	163	169	183
Less industrialized countries [4]	116	125	131	146	136	146	150	152
Latin America [5]	116	125	131	149	NA	NA	NA	NA
Asia, East and Southeast [6]	113	122	130	145	134	142	149	153
Communist Europe [7]	128	143	161	180	177	181	181	179
World	120	133	143	159	154	158	159	165
Overall industrial production:								
Non-Communist world	115	123	126	135	131	134	132	142
Industrialized countries [2]	115	123	126	134	131	133	131	141
United States and Canada	116	126	127	133	130	134	132	136
Europe	112	117	118	127	124	124	120	138
European Economic Community [3]	111	116	117	127	123	122	122	141
Less industrialized countries [4]	118	125	130	140	134	139	141	145
Latin America [5]	114	120	125	133	NA	NA	NA	NA
Asia, East and Southeast [6]	120	127	133	144	139	140	146	150
Communist Europe [7]	116	127	139	151	153	152	150	148
World	116	124	130	139	137	139	137	143

NA Not available.

[1] Excludes a number of countries of the Near East and Africa as well as mainland China, North Korea, and North Vietnam.

[2] All countries having a per capita value added in manufacturing in 1958 equivalent to US$125 or more.

[3] Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands.

[4] Countries having a per capita value added in manufacturing in 1958 of less than US$125.

[5] Central and South America and the Caribbean Islands.

[6] Afghanistan, Brunei, Burma, Ceylon, Hong Kong, India, Indonesia, Iran, South Korea, Malaysia (excluding Sabah), Mongolia, Pakistan, Philippines, Singapore, Taiwan, Thailand, and South Vietnam.

[7] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.

Source: United Nations Monthly Bulletin of Statistics. August 1969, pp. x-xxi.

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Table 2.—World production [1] of major minerals

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum—thousand metric tons	5,931	6,318	6,880	7,575	8,061
Antimony—do	68	68	61	58	62
Arsenic, white [2]—do	58	51	52	59	59
Bauxite—do	33,887	37,460	40,703	44,517	44,863
Beryl—metric tons	4,490	5,555	4,127	4,920	6,446
Bismuth [2]—do	3,016	3,085	3,188	3,587	3,790
Cadmium—do	12,804	12,007	13,102	13,003	14,557
Chromite—thousand metric tons	4,158	4,810	4,881	4,781	5,025
Cobalt [2]—metric tons	17,305	18,427	21,220	19,971	19,497
Columbium-tantalum concentrates [2 3]—do	5,332	6,631	10,447	9,549	9,063
Copper:					
Mine—thousand metric tons	4,813	5,044	5,272	5,017	5,362
Smelter—do	5,260	5,544	5,766	5,404	6,044
Gold—thousand troy ounces	44,841	46,225	46,580	45,708	46,191
Iron and steel:					
Iron ore—thousand metric tons	582,444	620,982	636,027	623,527	681,000
Pig iron (including ferroalloys)—do	317,353	335,138	347,290	356,745	386,091
Steel ingots (including castings)—do	437,694	458,761	475,071	492,232	527,552
Lead:					
Mine—do	2,522	2,695	2,849	2,874	3,016
Smelter—do	2,583	2,667	2,771	2,800	2,920
Magnesium—do	150	162	163	186	187
Manganese ore—do	16,087	17,743	18,001	16,678	17,730
Mercury—thousand 76-pound flasks	255	268	265	233	260
Molybdenum—metric tons	42,338	52,393	64,694	65,841	65,500
Nickel—thousand metric tons	371	426	414	448	483
Platinum-group metals—thousand troy ounces	2,546	2,969	3,005	3,170	3,365
Selenium [4]—metric tons	995	831	910	955	964
Silver—thousand troy ounces	248,545	257,415	266,731	260,778	274,929
Tellurium [3]—metric tons	126	145	151	125	115
Tin:					
Mine—long tons	193,457	201,115	208,071	215,006	227,581
Smelter—do	191,080	197,181	200,502	219,276	230,071
Titanium concentrates:					
Ilmenite [3]—thousand metric tons	2,350	2,454	2,619	2,739	2,946
Rutile [3]—do	195	r 222	r 250	r 306	r 324
Tungsten concentrate (contained tungsten)—metric tons	28,097	27,065	28,640	28,605	32,019
Uranium oxide (U_3O_8) [3]—do	23,772	18,675	17,708	17,217	20,474
Vanadium [3]—do	7,777	8,921	9,098	9,534	10,855
Zinc:					
Mine—thousand metric tons	4,033	4,308	4,497	4,836	4,967
Smelter—do	3,693	3,949	4,081	4,127	4,552
NONMETALS					
Asbestos—thousand metric tons	2,768	2,814	2,971	2,958	3,098
Barite—do	3,164	3,537	3,691	3,466	3,502
Cement, hydraulic—do	415,644	434,054	464,604	483,846	510,138

See footnotes at end of table.

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Table 2.—World production [1] of major minerals—Continued

Commodity	1964	1965	1966	1967	1968 [p]
NONMETALS—Continued					
Diamond:					
Gem—thousand carats	7,732	7,738	8,925	9,639	10,602
Industrial—do	30,121	29,329	31,076	31,808	25,785
Diatomite—thousand metric tons	1,451	1,489	1,523	1,552	1,388
Feldspar—do	1,950	2,035	2,181	2,042	2,221
Fluorspar—do	2,465	2,770	2,841	3,177	3,530
Graphite [2]—do	620	607	484	359	437
Gypsum—do	46,540	47,470	47,924	47,763	48,925
Magnesite [2]—do	9,540	10,044	10,075	10,287	10,019
Mica—do	178	190	181	182	193
Phosphate rock—do	56,899	63,776	75,480	78,140	83,743
Potash (marketable) K_2O equivalent—do	12,170	13,724	14,568	15,293	15,549
Pumice [3]—do	15,227	14,858	14,749	14,269	13,781
Pyrites, including cupreous—do	20,600	21,540	21,620	22,206	22,104
Salt—do	98,665	108,678	110,981	119,362	125,976
Strontium minerals [3]—metric tons	23,818	14,008	16,744	13,083	15,951
Sulfur:					
Native—thousand metric tons	8,832	9,738	10,885	11,399	12,251
Byproduct elemental—do	5,334	5,836	5,861	6,526	6,690
Talc, soapstone, and pyrophyllite—do	3,520	3,571	3,716	3,998	4,485
Vermiculite [3]—do	311	344	346	336	381
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—do	186,519	189,443	189,522	181,315	181,622
Bituminous—do	1,820,933	1,866,643	1,900,910	1,813,419	1,878,707
Lignite—do	742,013	737,347	733,354	718,918	723,640
Total—do	2,749,465	2,793,433	2,823,786	2,713,652	2,783,969
Coke:					
Metallurgical—do	298,534	310,293	310,433	303,482	314,223
Other types—do	37,322	34,848	33,605	31,398	28,615
Fuel briquets—do	120,950	115,100	111,950	110,000	105,691
Gas, natural (marketed)—billion cubic feet	22,867	24,480	26,394	28,409	31,032
Peat—thousand metric tons	176,975	182,912	203,247	198,289	199,024
Petroleum crude—thousand barrels	10,311,134	11,058,462	12,019,964	12,873,486	14,168,036

[p] Preliminary.
[1] Incorporates numerous revisions from world production tables and country production tables appearing in Volumes I–II and IV respectively of the Minerals Yearbook. Data revised through September 30, 1969.
[2] United States data withheld to avoid disclosing individual company data.
[3] Excludes production from Communist countries; Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, mainland China, Mongolia, North Korea, North Vietnam, Poland, Rumania, U.S.S.R., and Yugoslavia.
[4] Excludes production from Communist countries other than Yugoslavia.

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Table 3.—Approximate percentage distribution of world mineral production by major areas in 1968[1]

Commodity	Western Hemisphere			Eastern Hemisphere							World	
				Europe			Near East and Asia					
	North and Central America[2]	South America	Total	Non-Communist[3]	Communist[4]	Africa	Non-Communist	Communist[5]	Oceania	Total	Non-Communist	Communist[3]
METALS												
Aluminum:												
Bauxite	26.0	19.3	45.3	15.2	15.6	6.1	5.8	0.9	11.1	54.7	83.5	16.5
Ingot	48.0	1.2	49.2	21.8	17.1	1.9	7.7	1.1	1.2	50.8	81.8	18.2
Antimony	8.1	19.2	27.3	4.7	12.1	29.3	5.8	19.4	1.4	72.7	68.5	31.5
Arsenic, white	[6] 28.3	2.6	25.9	60.3	11.8	.8	1.2	(7)	-------	74.1	88.2	11.8
Beryl	2.4	41.4	43.8	1.6	18.6	15.3	20.2	-------	.5	56.2	81.4	18.6
Bismuth	[6] 21.5	36.2	57.7	7.8	1.1	.1	21.8	6.6	4.9	42.3	92.3	7.7
Cadmium	41.1	1.2	42.3	18.1	18.2	2.2	15.4	.7	3.1	57.7	81.1	18.9
Chromite	(7)	.3	.3	1.9	39.3	28.9	29.6	(7)	-------	99.7	60.7	39.3
Cobalt	[6] 13.8	-------	13.8	12.8	7.2	65.2	-------	-------	1.0	86.2	87.1	12.9
Columbium-tantalum [8]	[6] 21.2	58.9	80.1	.3	XX	17.3	1.0	XX	1.3	19.9	100.0	XX
Copper:												
Mine	32.2	16.5	48.7	2.9	16.5	22.2	5.8	1.9	2.0	51.3	81.5	18.5
Smelter	27.9	13.5	41.4	11.1	15.2	19.2	9.7	1.9	1.5	58.6	82.9	17.1
Gold	9.8	1.4	11.2	.5	13.1	70.6	2.1	.5	2.0	88.8	86.4	13.6
Iron and steel:												
Iron ore	19.9	9.1	29.0	19.7	27.9	7.1	5.8	6.6	3.9	71.0	65.5	34.5
Pig iron (including ferroalloys)	24.0	1.4	25.4	26.2	26.0	1.1	14.5	5.4	1.4	74.6	68.6	31.4
Steel ingots and castings	25.2	1.4	26.6	27.2	26.8	.8	14.2	3.2	1.2	73.4	70.0	30.0
Lead:												
Mine	27.9	8.3	36.2	15.1	20.6	5.8	3.8	5.6	12.9	63.8	73.8	26.2
Smelter	26.7	4.3	31.0	22.2	21.4	4.1	6.2	5.3	9.8	69.0	73.3	26.7
Magnesium	52.4	-------	52.4	22.7	21.4	-------	3.0	.5	-------	47.6	78.1	21.9
Manganese ore	.5	9.0	9.5	.5	44.1	24.1	12.1	5.1	4.6	90.5	50.8	49.2
Mercury	19.6	1.6	21.2	48.3	17.7	.1	5.0	7.7	-------	78.8	74.6	25.4
Molybdenum	78.7	7.1	85.8	.4	10.7	(7)	.8	2.3	-------	14.2	87.0	13.0
Nickel	58.0	.2	58.2	1.5	20.0	1.2	1.6	-------	17.5	41.8	74.4	25.6
Platinum-group metals	14.2	.5	14.7	-------	59.4	25.7	.2	-------	-------	85.3	40.6	59.4
Selenium [9]	63.2	.6	63.8	14.5	XX	2.7	18.8	XX	.2	36.2	100.0	XX
Silver	44.8	17.5	62.3	6.2	14.8	3.2	5.1	.5	7.9	37.7	84.7	15.3
Tellurium [8]	73.8	14.0	87.8	-------	XX	-------	12.2	XX	(7)	12.2	100.0	XX
Tin:												
Mine	[6] .3	13.9	14.2	1.3	11.9	9.3	51.6	8.8	2.9	85.8	79.3	20.7
Smelter	1.6	.6	2.2	18.3	11.8	5.4	52.0	8.7	1.6	97.8	79.5	20.5
Titanium:												
Ilmenite [8]	50.9	.6	51.5	20.6	XX	(7)	8.9	XX	19.0	48.5	100.0	XX
Rutile [8]	(6)	(10)	(10)	-------	XX	8.0	1.2	XX	90.8	100.0	100.0	XX
Tungsten	19.3	9.2	28.5	4.8	19.4	1.6	10.4	31.7	3.6	71.5	48.9	51.1
Uranium oxide (U_3O_8)[8]	71.1	.2	71.3	7.5	XX	19.7	(7)	XX	1.5	28.7	100.0	XX
Vanadium [8]	54.2	-------	54.2	18.9	XX	26.9	-------	XX	-------	45.8	100.0	XX

See footnotes at end of table.

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Table 3.—Approximate percentage distribution of world mineral production by major areas in 1968 [1]—Continued

Commodity	Western Hemisphere			Eastern Hemisphere							World	
				Europe			Near East and Asia					
	North and Central America [2]	South America	Total	Non-Communist [3]	Communist [4]	Africa	Non-Communist	Communist [5]	Oceania	Total	Non-Communist	Communist [2]
METALS—Continued												
Zinc:												
Mine	38.1	7.0	45.1	13.8	15.9	5.8	6.6	4.8	8.5	54.9	79.8	20.2
Smelter	30.6	2.1	32.7	24.4	18.2	2.6	13.8	3.7	4.6	67.3	78.1	21.9
NONMETALS												
Asbestos	50.3	.1	50.4	4.1	25.9	12.9	1.9	4.8	(10)	49.6	69.3	30.7
Barite	34.6	4.0	38.6	32.9	11.3	3.3	6.9	6.6	.4	61.4	82.1	17.9
Cement, hydraulic	17.1	3.8	20.9	31.5	24.8	2.0	17.5	2.4	.9	79.1	72.8	27.2
Diamond:												
Gem	-----	2.3	2.3	-------	13.2	84.3	.2	-------	-------	97.7	86.8	13.2
Industrial	-----	1.0	1.0	-------	21.7	77.2	.1	-------	-------	99.0	78.3	21.7
Diatomite	42.4	.3	42.7	29.3	25.9	1.6	.2	-------	.3	57.3	74.1	25.9
Feldspar	34.7	2.0	36.7	42.3	12.1	1.3	7.4	(7)	.2	63.3	87.9	12.1
Fluorspar	35.3	(7)	35.3	30.1	13.0	3.2	8.8	9.6	(7)	64.7	77.4	22.6
Graphite	[6] 12.1	.5	12.6	10.8	16.0	3.9	32.7	24.0	-------	87.4	60.0	40.0
Gypsum	33.2	1.4	34.6	39.1	13.2	2.2	8.1	1.1	1.7	65.4	85.7	14.3
Magnesite	(6)	1.1	1.1	24.4	48.3	.7	3.8	21.5	.2	98.9	30.2	69.8
Mica, including scrap	59.3	2.2	61.5	3.4	18.7	4.9	11.5	(7)	(7)	38.5	81.3	18.7
Phosphate rock	44.8	.4	45.2	.1	21.2	28.7	3.7	2.8	3.3	54.8	76.0	24.0
Potash (marketable) K_2O equivalent	32.7	-------	32.7	30.8	34.5	-------	2.0	-------	-------	67.3	65.5	34.5
Pumice	24.9	1.1	26.0	73.8	XX	.1	(7)	XX	.1	74.0	100.0	XX
Pyrites, including cupreous	5.3	-------	5.3	33.8	19.9	5.3	25.8	9.1	.8	94.7	71.0	29.0
Salt	36.8	3.1	39.9	23.1	14.3	1.8	7.8	12.4	.7	60.1	73.3	26.7
Strontium minerals [8]	21.7	.4	22.1	73.8	XX	-------	4.1	XX	-------	77.9	100.0	XX
Sulfur:												
Native	75.2	1.3	76.5	.8	19.3	.1	2.3	1.0	-------	23.5	79.7	20.3
Byproduct elemental	57.0	.1	57.1	30.4	8.8	.1	1.7	1.9	-------	42.9	89.3	10.7
Talc, soapstone, and pyrophyllite	21.0	2.2	23.2	13.5	11.1	.9	45.7	4.7	.9	76.8	84.2	15.8
Vermiculite [8]	69.1	1.3	70.4	-------	XX	29.0	.6	XX	-------	29.6	100.0	XX
MINERAL FUELS AND RELATED MATERIALS												
Coal, all grades including lignite	18.8	.3	19.1	18.1	41.3	2.0	5.5	11.6	2.4	80.9	47.1	52.9
Coke:												
Metallurgical	20.3	.7	21.0	28.3	32.0	1.0	11.0	5.4	1.3	79.0	62.6	37.4
Other types	.5	1.0	1.5	30.9	37.6	.7	26.8	(7)	2.5	98.5	62.4	37.6
Fuel briquets	(7)	(10)	(10)	20.5	68.0	(10)	10.0	-------	1.5	100.0	32.0	68.0
Gas, natural (marketed)	68.7	1.9	70.6	4.6	22.7	.3	1.8	-------	(10)	29.4	77.3	22.7
Peat	.4	(7)	.4	4.0	95.5	-------	.1	-------	-------	99.6	4.5	95.5
Petroleum, crude	28.2	11.5	39.7	1.0	16.8	10.2	31.5	.7	.1	60.3	82.5	17.5

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XX Not applicable.
[1] Data presented in this table have been calculated from production figures that include additions and revisions to all data appearing elsewhere in the 1968 Minerals Yearbook. Data revised through September 30, 1969.
[2] Includes Cuba.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[5] Includes mainland China, Mongolia, North Korea, and North Vietnam.
[6] United States data withheld to avoid disclosing individual company data and not included in total upon which percentages have been calculated.
[7] Quantity of production not known. No estimate included in total.
[8] Excludes production from Communist countries; Albania, Bulgaria, Cuba, Czechoslovakia, East Germany, Hungary, mainland China, Mongolia, North Korea, North Vietnam, Poland, Rumania, U.S.S.R. and Yugoslavia.
[9] Excludes production from Communist countries other than Yugoslavia.
[10] Less than .05 percent.

Table 4.—Value of world trade in major mineral commodities [1] by regions [2] and major commodity groups

(Million dollars)

Area and country [2]	Mineral commodities								All commodities	
	Exports				Imports					
	Metal ores concentrates and scrap	Metals	Mineral fuels	Total	Metal ores and scrap	Metals	Mineral fuels	Total	Exports	Imports
1964 total	4,360	14,270	17,010	35,640	4,360	14,270	17,010	35,640	172,160	172,160
1965 total	4,580	16,390	17,920	38,890	4,580	16,390	17,920	38,890	186,390	186,390
1966 total [r]	4,760	17,690	18,890	41,340	4,760	17,690	18,890	41,340	203,400	203,400
1967:										
Northern North America:										
United States	520	1,110	1,100	2,730	920	3,110	2,250	6,280	31,240	26,070
Canada	940	1,285	560	2,785	140	480	690	1,310	10,560	9,670
Total [3]	1,460	2,395	1,660	5,515	1,060	3,590	2,940	7,590	41,800	35,740
Latin America	740	1,051	2,860	4,651	51	700	660	1,411	11,700	10,600
Europe:										
Non-Communist:										
EEC	520	6,150	2,380	9,050	1,430	5,230	5,690	12,350	56,140	52,610
EFTA	335	2,540	530	3,405	650	2,580	3,060	6,290	28,650	32,720
Other [3]	75	330	130	535	60	830	890	1,780	6,040	9,870
Subtotal	930	9,020	3,040	12,990	2,140	8,640	9,640	20,420	90,830	95,200
Communist	445	2,170	2,420	5,035	480	1,950	1,350	3,780	22,820	21,110
Total [3]	1,375	11,190	5,460	18,025	2,620	10,590	10,990	24,200	113,650	116,310

See footnotes at end of table.

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Table 4.—Value of world trade in major mineral commodities [1] by regions [2] and major commodity groups—Continued

(Million dollars)

Area and country [2]	Mineral commodities									
	Exports				Imports				All commodities	
	Metal ores concentrates and scrap	Metals	Mineral fuels	Total	Metal ores and scrap	Metals	Mineral fuels	Total	Exports	Imports
1967—Continued										
Africa:										
Republic of South Africa	(4)	(4)	86	86	7	164	155	326	1,900	2,530
Other	355	[6] 1,070	2,080	3,505	10	439	540	989	8,360	8,330
Total [3]	[5] 355	[5] 1,070	2,166	3,591	17	603	695	1,315	10,260	10,860
Near East	(4)	(4)	6,610	6,610	2	371	365	738	7,860	5,120
South Asia and Far East:										
Japan	(4)	1,375	33	1,408	1,160	805	2,000	3,965	10,440	9,350
Other non-Communist	410	465	700	1,575	59	1,005	980	2,044	10,000	14,580
Subtotal	[5] 410	1,840	733	2,983	1,219	1,810	2,980	6,009	20,440	24,430
Communist	(4)	128	30	158	24	384	64	472	2,070	2,350
Total [3]	[5] 410	1,968	763	3,141	1,248	2,194	3,044	6,481	22,510	26,780
Australia and New Zealand	(4)	255	130	385	6	203	295	504	4,270	4,080
Rest of world	275	--------	950	1,225	7	74	1,060	1,141	2,080	3,130
Not reported [3]	405	411	11	827	14	15	561	590	--------	1,510
Grand total 1967	5,020	18,340	20,610	43,970	5,020	18,340	20,610	43,970	214,130	214,130

r Revised.

[1] Commodities included are as follows: SITC (Standard International Trade Classification) categories; (1) Division 28—Metal ores concentrates, and scrap; Section 3—Mineral Fuels, lubricants and related materials; Division 67—Iron and steel; Division 68—Nonferrous metals.

[2] Regional groupings generally conform to United Nations practice; modifications and special aspects of classification scheme are as follows: (1) Latin America includes Mexico, Central America, and South America, but excludes Caribbean Islands; (2) EEC consists of Belgium, France, West Germany, Italy, Luxembourg, and the Netherlands; (3) EFTA consists of Austria, Denmark, Norway, Portugal, Sweden, Switzerland, and the United Kingdom; (4) Other non-Communist Europe consists of Finland, Greece, Iceland, Ireland, and Spain as well as Yugoslavia (a Communist country) and Turkey (a Near East country); (5) Communist Europe includes Albania, Bulgaria, Czechoslovakia, Hungary, Poland, Rumania, and the U.S.S.R.; (6) Other Africa corresponds to the United Nations category "Developing Africa;" (7) Near East corresponds to the United Nations category "Western Asia"; (8) Other non-Communist South Asia and Far East corresponds to the United Nations category "Other developing Asia"; (9) Communist Far East consists of China (mainland), North Korea, Mongolia, and North Vietnam; (10) Rest of world is taken directly from source and reportedly consists mainly of Caribbean and Pacific Islands; (11) Not reported is derived by subtracting all listed figures from reported totals.

[3] Data not reported in source but derived from data therein.

[4] Not listed separately, presumably included under "Not reported." (See below in body of table.)

[5] Partial total, exclusions indicated by footnotes 4 and 6 applied to detail.

[6] Nonferrous metals only; iron and steel presumably included under "Not reported." (See below in body of table.)

Source: United Nations. Monthly Bulletin of Statistics. March 1969, pp. xviii–xix; May 1969, pp. xxviii, xxx–xxxiv.

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Table 5.—Direction of trade in major mineral commodities [1] in 1967

(Million dollars)

Sources	Destinations [2]									
	Northern North America			Latin America	Non-Communist Europe				Communist Europe	Near East
	United States	Canada	Total [3]		EEC	EFTA	Other [3]	Total		
Northern North America:										
United States	XX	628	628	307	546	247	61	854	4	31
Canada	1,685	XX	1,685	50	189	526	23	738	2	1
Total [3]	1,685	628	2,313	357	735	773	84	1,592	6	32
Latin America	1,573	267	1,840	374	696	499	76	1,271	34	1
Europe:										
Non-Communist:										
EEC	733	56	789	190	4,550	1,549	466	6,565	276	189
EFTA	338	72	410	71	1,045	952	243	2,240	194	62
Other [3]	32	1	33	4	205	114	26	345	85	10
Subtotal	1,103	129	1,232	265	5,800	2,615	735	9,150	555	261
Communist	35	7	42	143	551	365	387	1,303	3,015	51
Total [3]	1,138	136	1,274	408	6,351	2,980	1,122	10,453	3,570	312
Africa:										
Republic of South Africa [5]	2	----	2	----	4	1	----	5	----	----
Other [6]	166	29	195	22	2,035	650	120	2,805	25	3
Total	168	29	197	22	2,039	651	120	2,810	25	3
Near East [5]	180	69	249	105	2,050	1,040	320	3,410	----	320
South Asia and Far East:										
Japan [7]	582	37	619	79	32	11	12	55	22	35
Other non-Communist	238	12	250	8	141	47	11	199	36	23
Subtotal [3]	820	49	869	87	173	58	23	254	58	58
Communist Far East [7]	----	----	----	2	15	4	----	19	62	1
Total [3]	820	49	869	89	188	62	23	273	120	59
Australia and New Zealand [7]	27	3	30	1	16	54	5	75	----	1
Rest of world	545	122	667	61	68	153	22	243	----	2
Grand total [4]	6,280	1,810	7,590	1,411	12,350	6,290	1,780	20,420	3,780	738

See footnotes at end of table.

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Table 5.—Direction of trade in major mineral commodities [1] in 1967—Continued

(Million dollars)

Sources	Africa			South Asia and Non-Communist Far East			Communist Far East	Australia and New Zealand	Rest of world	Grand total [4]
	Republic of South Africa	Other	Total [3]	Japan	Other	Total [3]				
Northern North America:										
United States	16	43	59	554	242	796	--------	26	31	2,730
Canada	15	0	15	228	36	264	2	25	6	2,785
Total [3]	31	43	74	782	278	1,060	2	51	37	5,515
Latin America	1	13	14	280	10	290	2	2	830	4,651
Europe:										
Non-Communist:										
EEC	35	308	343	78	152	230	162	12	29	9,050
EFTA	55	63	118	57	98	155	65	59	33	3,405
Other [5]	102	9	111	18	12	30	--------	--------	--------	535
Subtotal	192	380	572	153	262	415	227	71	[4] 61	12,990
Communist	--------	84	84	212	76	288	113	--------	--------	5,035
Total	192	464	656	365	338	703	340	71	[4] 61	18,025
Africa:										
Republic of South Africa [5]	XX	22	22	3	--------	3	--------	--------	--------	86
Other [6]	62	103	165	169	11	180	9	--------	32	3,505
Total [3]	62	125	187	172	11	183	9	--------	32	3,591
Near East [5]	115	215	330	1,420	420	1,840	--------	185	62	6,610
South Asia and Far East:										
Japan [7]	10	31	41	XX	403	403	112	47	7	1,408
Other non-Communist	--------	18	18	479	455	934	2	87	10	1,575
Subtotal [3]	10	49	59	479	858	1,337	114	134	17	2,983
Communist Far East [7]	--------	4	4	48	23	71	--------	--------	--------	158
Total [3]	10	53	63	527	881	1,408	114	134	17	3,141
Australia and New Zealand [7]	2	2	4	117	67	184	4	57	20	385
Rest of World [8]	3	34	37	59	26	85	--------	2	89	1,225
Grand total [4]	326	989	1,315	3,965	2,044	6,009	472	504	1,141	43,970

XX Not applicable.
[1] Commodities included as detailed in footnote 1, table 4, this section.
[2] Regional groupings as detailed in footnote 2, table 4, this section.
[3] Not reported in Source; derived from data therein.
[4] As reported in Source; does not add.
[5] Includes mineral fuels only.
[6] Excludes iron and steel.
[7] Excludes metal ores and scrap.
[8] Includes iron and steel and nonferrous metals only.
Source: United Nations, Monthly Bulletin of Statistics. New York. March 1969, pp. xxiv–xxv; May 1969, pp. xxvi–xxviii, xxx–xxxiv.

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Table 6.—Summary of trade in major mineral commodities[1] by industrialized and less developed countries[2]

Sources	Value distribution by destinations (million dollars)			Percentage distribution of world total value by destinations (percent)		
	Industrialized countries	Less developed countries	Total	Industrialized countries	Less developed countries	Total
1965:						
Industrialized countries	19,314	3,469	22,783	50.2	9.0	59.2
Less developed countries	12,262	3,435	15,697	31.9	8.9	40.8
World	31,576	6,904	38,480	82.1	17.9	100.0
1966:						
Industrialized countries	20,551	3,590	24,141	49.6	8.7	58.3
Less developed countries	13,746	3,563	17,309	33.1	8.6	41.7
World	34,297	7,153	41,450	82.7	17.3	100.0
1967:						
Industrialized countries	21,744	3,675	25,419	49.4	8.4	57.8
Less developed countries	14,841	3,710	18,551	33.8	8.4	42.2
World	36,585	7,385	43,970	83.2	16.8	100.0

[1] Commodities listed in table 4 of this chapter.
[2] Countries classified as industrialized for this table include the United States, Canada, all countries of Europe (Communist and non-Communist), the Republic of South Africa, Japan, Australia, and New Zealand. Following United Nations' practice, Turkey is included with Europe.

Source: Data for 1967 are derived from figures in table 5 of this chapter, data for 1965 and 1966 are derived from previous editions of this table.

Table 7.—Estimated world[1] consumption of major nonferrous metals

		1964	1965	1966	1967[r]	1968
Aluminum[2]	thousand metric tons	[r] 5,837	[r] 6,497	[r] 7,034	7,246	8,179
Copper[3]	do	[r] 5,919	[r] 6,110	[r] 6,406	6,091	6,388
Lead[4]	do	2,783	2,794	[r] 2,936	3,021	3,162
Zinc[5]	do	3,864	[r] 4,017	[r] 4,100	4,081	4,288
Tin[6]	thousand long tons	168	165	166	164	170

[r] Revised.
[1] In general, major consuming countries only have been included; sum of consumption by excluded minor consumers may be significant; data included for Communist countries, except Yugoslavia, are listed as conjectural in source.
[2] Apparently includes secondary metal.
[3] Primary and secondary refined.
[4] Chiefly primary; may include some secondary.
[5] Primary and secondary slab.
[6] Primary only. As reported by the International Tin Council. Communist countries, except for Yugoslavia, are excluded.

Source: Yearbook of the American Bureau of Metal Statistics. Forty-Eighth Annual Issue for the year 1968. New York, 1969, 148 pp.

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Table 8.—World energy consumption [1] by fuel and continental area

(Million metric tons of standard coal equivalent unless otherwise specified)

Area [2] and year	Solid fuels	Liquid fuels	Natural and imported gas	Hydro, nuclear, and imported electricity	Total aggregate [2]	Total per capita (kilograms)
North America:						
1964	424	758	630	37	1,849	8,743
1965	448	795	657	40	1,940	9,052
1966	471	834	707	42	2,053	9,459
1967	463	870	744	46	2,123	9,665
Caribbean America:						
1964	5	64	25	2	95	922
1965	4	69	26	2	101	949
1966	5	71	28	2	106	965
1967	5	75	30	3	113	998
Other America:						
1964	6	58	9	4	76	566
1965	6	60	10	4	79	578
1966	6	65	10	5	86	607
1967	7	68	11	5	90	618
Western Europe:						
1964	539	416	25	34	1,014	2,986
1965	515	466	28	39	1,048	3,057
1966	486	522	38	48	1,084	3,138
1967	459	552	41	44	1,096	3,148
Africa:						
1964	49	31	1	2	83	271
1965	53	32	2	2	89	283
1966	52	36	2	2	92	288
1967	54	36	2	2	94	285
Near East:						
1964	6	28	6	(3)	40	456
1965	6	31	6	(3)	43	476
1966	6	33	7	(3)	47	510
1967	6	37	7	(3)	51	538
Far East:						
1964	144	133	9	12	298	306
1965	151	152	10	12	324	324
1966	154	175	10	14	353	345
1967	165	209	11	12	397	378
Oceania:						
1964	31	23	(3)	2	56	3,316
1965	32	26	(3)	2	60	3,469
1966	32	28	(3)	2	63	3,559
1967	33	30	(3)	2	65	3,629
Countries not elsewhere specified: [4]						
1964	1,021	271	168	14	1,473	1,402
1965	1,036	291	196	16	1,539	1,445
1966	1,078	316	218	18	1,631	1,511
1967	982	341	242	17	1,582	1,448
World total:						
1964	2,224	1,782	871	107	4,984	1,547
1965	2,251	1,920	933	118	5,222	1,589
1966	2,292	2,080	1,015	128	5,515	1,648
1967	2,173	2,219	1,088	131	5,611	1,647

[1] In most cases, data are aggregates of country figures representing apparent inland consumption—the purely arithmetic result of adding production and imports and subtracting from this sum, the total of exports, bunker loadings and additions to stocks (where the latter are known). All totals in this table are as reported in source and may not represent the sum of listed parts owing to rounding and/or omission from detail of minor quantities not listed separately.

[2] Areas listed are those appearing in source and have not been conformed to standard terms used elsewhere in the Minerals Yearbook, except that the source term "Western Asia" has been converted to "Near East."

[3] Nil or less than ½ unit.

[4] The greatest part of the consumption listed under this heading is that of Eastern Europe—Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania and the U.S.S.R.

Source: United Nations. World Energy Supplies. Statistical Papers, Series J, No. 12, New York, 1969, pp. 10–18.

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Table 9.—Annual investment expenditures in the steel industry for selected countries

(Million dollars)

	1964	1965	1966	1967	1968
European Economic Community (EEC)[1]	r 1,315	932	r 848	730	822
European Free Trade Association (EFTA)[2]	r 261	261	r 267	272	211
Other countries:					
Canada	191	r 151	r 195	108	NA
Ireland	1	1	(3)	1	(3)
Japan [4]	460	454	540	r 842	1,167
Spain	109	116	143	186	NA
Turkey	-------	-------	10	10	8
United States	1,600	r 1,823	1,953	2,173	2,436

r Revised. NA Not available.
[1] European Coal and Steel Commission, Investment in the Community Coal Mining and Steel Industries. Report on the 1969 Survey, 1969 p. 8.
[2] Totals given exclude expenditures, if any, for Denmark and Switzerland in every year, and for 1968 also exclude Austria, Norway, and any non British Steel Corporation investment in the United Kingdom.
[3] Less than ½ unit.
[4] Japanese fiscal years.

Source: Except as otherwise noted, Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1968 and Trends in 1969, and previous editions of the same publication covering 1964 and 1965, 1965 and 1966, 1966 and 1967, and 1967 and 1968.

Table 10.—Non-Communist world petroleum industry capital expenditures and exploration expenses by geographic area

(Million dollars)

	1964	1965	1966	1967
United States:				
Capital expenditures	6,100	6,375	7,125	7,650
Exploration expenses	650	610	650	615
Total	6,750	6,985	7,775	8,265
Other Western Hemisphere:				
Capital expenditures	1,425	1,550	1,785	1,860
Exploration expenses	170	195	210	250
Total	1,595	1,745	1,995	2,110
Western Europe:				
Capital expenditures	1,725	2,050	2,500	2,725
Exploration expenses	90	150	75	100
Total	1,815	2,200	2,575	2,825
Africa:				
Capital expenditures	575	600	560	600
Exploration expenses	115	100	75	100
Total	690	700	635	700
Middle East:				
Capital expenditures	275	625	600	550
Exploration expenses	30	35	50	50
Total	305	660	650	600
Far East:				
Capital expenditures	900	800	840	975
Exploration expenses	75	90	50	75
Total	975	890	890	1,050
Unspecified: Capital expenditures (no exploration expenses)	1,275	1,175	1,265	1,215
Total:				
Capital expenditures	12,275	13,175	14,675	15,575
Exploration expenses	1,130	1,180	1,110	1,190
Total	13,405	14,355	15,785	16,765

Source: Energy Division, Chase Manhattan Bank N.A. Capital Investments of the World Petroleum Industry. December 1968, pp. 24–31.

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Table 11.—Non-Communist world petroleum industry capital expenditures by industry sector and exploration expenses

(Million dollars)

	1964	1965	1966	1967
Capital expenditures:				
Production	5,565	5,785	5,640	6,000
Pipelines	555	550	760	860
Marine	1,355	1,225	1,295	1,280
Refineries	1,565	1,865	2,670	2,585
Chemical plants	625	925	1,340	1,565
Marketing	2,190	2,430	2,410	2,705
Other	420	895	560	580
Total	12,275	13,175	14,675	15,575
Exploration expenses	1,130	1,180	1,110	1,190
Grand total	13,405	14,355	15,785	16,765

Source: Energy Division, Chase Manhattan Bank, N.A. Capital Investment of the World Petroleum Industry, 1967. December 1968, p. 24.

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Table 12.—U.S. direct foreign investment in mineral industries: Value, earnings and income

(Million dollars)

Area and country	Mining and smelting			Petroleum		
	Value	Earnings [1]	Income [1]	Value	Earnings [1]	Income [1]
1966						
Canada	r 2,089	191	120	r 3,608	196	114
Latin American Republics:						
South America:						
Venezuela	(2)	(2)	(2)	r 1,862	384	385
Other	(2)	(2)	(2)	r 678	74	78
Subtotal	r 986	235	218	r 2,540	458	463
Other	162	28	16	r 357	21	8
Total	1,148	263	234	2,897	479	471
Other Western Hemisphere	r 367	96	93	r 578	32	26
Europe:						
EEC	17	(2)	(2)	r 1,980	−39	17
Non-EEC:						
United Kingdom	3	(2)	(2)	r 1,169	−25	−15
Other	34	(2)	(2)	832	−15	3
Total Europe	54	10	11	r 3,981	−79	4
Africa:						
Republic of South Africa	73	45	33	r 138	(2)	(2)
Other	r 295	33	25	r 966	(2)	(2)
Total	r 368	78	58	r 1,104	259	243
Middle East	3	-------	-------	r 1,557	863	852
Far East	37	4	1	r 913	68	54
Oceania:						
Australia	r 251	18	6	(2)	(2)	(2)
Other	(2)	(2)	(2)	(2)	(2)	(2)
Total	r 251	18	6	521	2	−8
International shipping	------	-------	-------	1,047	40	23
Grand total [4]	r 4,315	660	524	r 16,205	1,859	1,778
1967 p						
Canada	2,337	240	154	3,819	207	132
Latin American Republics:						
South America:						
Venezuela	(2)	(2)	(2)	1,789	380	374
Other	(2)	(2)	(2)	743	80	65
Subtotal	1,065	265	250	2,532	460	439
Other	153	30	15	385	15	6
Total	1,218	295	265	2,917	475	445
Other Western Hemisphere	431	101	100	585	57	35
Europe:						
EEC	19	(2)	(2)	2,063	−24	35
Non-EEC:						
United Kingdom	2	(2)	(2)	1,429	−53	−17
Other	40	(2)	(2)	912	−22	−12
Total Europe	61	6	7	4,404	−99	6
Africa:						
Republic of South Africa	99	45	29	142	(2)	(2)
Other	299	29	31	1,090	(2)	(2)
Total	398	74	60	1,232	268	252
Middle East	3	-------	-------	1,607	983	1,010
Far East	40	5	1	992	115	87
Oceania:						
Australia	320	20	8	(2)	(2)	(2)
Other	2	1	1	(2)	(2)	(2)
Total	322	21	9	591	−4	−19
International shipping	------	-------	-------	1,264	117	41
Grand total [4]	4,810	743	596	17,410	2,118	1,989

p Preliminary. r Revised.

[1] Earnings is the sum of the U.S. share in the net earnings of subsidiary and branch profits; income is the sum of dividends, interest, and branch profits.

[2] Combined in other industries in source.

[3] Less than $500,000.

[4] Detail may not add to totals shown because of independent rounding.

Source: U.S. Department of Commerce. Survey of Current Business. V. 47, No. 9, September 1967, pp. 42–43; v. 48, No. 10, October 1968, pp. 24–25.

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Table 13.—World merchant fleet distribution by type[1]

	1964	1965	1966	1967	1968
Number of vessels:					
Tankers	3,488	3,582	3,610	3,740	3,895
Bulk carriers	1,822	1,971	2,039	2,368	2,609
Freighters	11,065	11,019	10,908	10,963	11,052
Other	1,745	1,757	1,746	1,729	1,805
Total	18,115	18,329	18,303	18,800	19,361
Gross tonnage:					
Tankers thousand tons	52,403	57,032	58,999	65,804	71,641
Bulk carriers do	17,337	20,696	22,350	31,644	37,596
Freighter do	61,219	61,397	61,025	61,821	62,559
Other do	12,716	12,743	12,674	12,253	12,446
Total do	143,675	151,868	155,048	171,522	184,242
Deadweight tonnage:					
Tankers do	81,742	89,723	93,022	105,542	117,135
Bulk carriers do	26,354	31,531	34,177	49,638	59,926
Freighters do	86,766	86,587	85,852	86,107	86,702
Other do	9,292	9,388	9,363	9,116	9,447
Total do	204,154	217,229	222,414	250,403	273,210

[1] Maritime Administration classification. Tankers include whaling tankers; vessels shown here as Other include: Combination passenger and cargo, combination passenger and refrigerated cargo, and refrigerated freighters. Contribution of these vessels to mineral commodity trade is regarded as unimportant. Data are as of December 31 of year indicated.

Table 14.—Distribution of world oil tanker tonnage by size groups[1]

Size group (deadweight tons)	1966		1968			
			In service		New building in progress or on order at yearend	
	Million deadweight tons	Percent of total	Million deadweight tons	Percent of total	Million deadweight tons	Percent of total
Under 25,000	30.0	30.2	29.8	24.9	1.8	2.5
25,000–45,000	25.3	25.5	25.6	21.4	.5	.9
45,000–65,000	21.2	21.3	22.1	18.5	.2	.4
65,000–85,000	12.7	12.8	15.7	13.1	1.4	2.7
85,000–105,000	6.6	6.6	12.9	10.8	2.4	4.6
105,000–125,000	2.5	2.5	4.8	4.0	1.6	3.0
125,000–145,000	--	--	1.4	1.2	1.5	2.9
145,000–165,000	--	--	1.2	1.0	1.6	3.0
165,000–185,000	1.1	1.1	.7	.6	.4	.8
185,000–205,000	--	--	1.9	1.6	4.9	9.3
205,000 and over	--	--	3.4	2.9	36.8	69.9
Total	[2] 99.4	100.0	[2] 119.5	100.0	52.6	100.0

[1] Includes vessels 2,000 deadweight tons and over.
[2] Data differ slightly from total given in table 13 owing to difference in source.

Sources: British Petroleum Co. Ltd. BP Statistical Review of the World Oil Industry. Baynard Press, London, 1966, p. 15; 1968, p. 15.

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Table 15.—Indexes of ocean freight rates

(1963 =100)

	London tanker brokers panel	Trip charter				
		West Germany		Netherlands (general)	Norway	
		Dry cargo	Tankers		Dry cargo	Tankers
1964	89	101	90	114	100	92
1965	90	110	90	114	112	90
1966	89	100	84	100	97	84
1967:[1]						
First quarter	[2] 80	91	112	[3] 83	92	67
Second quarter	NA	102	117	[3] 82	101	198
Third quarter	142	111	246	[3] 98	116	260
Fourth quarter	129	117	152	[3] 105	114	146
Annual average	109	102	154	92	104	155
1968:[1]						
First quarter	107	100	150	[3] 94	104	129
Second quarter	121	98	200	NA	102	177
Third quarter	102	98	145	NA	101	125
Fourth quarter	106	104	172	NA	102	152
Annual average	108	100	158	NA	102	142

	Trip charter				Time charter	
	United Kingdom					
	General	Coal trade	Ore trade	Fertilizer trade	Norway (dry cargo)	United Kingdom (dry cargo)
1964	103	96	103	112	112	114
1965	116	105	120	136	126	128
1966	104	88	94	128	113	126
1967:[1]						
First quarter	97	80	72	146	102	113
Second quarter	104	92	[4] 70	[5] 142	103	116
Third quarter	115	116	NA	NA	131	140
Fourth quarter	134	111	[6] 120	239	126	132
Annual average	111	95	85	186	113	124
1968:[1]						
First quarter	121	94	NA	215	120	136
Second quarter	116	92	NA	213	116	139
Third quarter	109	90	NA	197	117	128
Fourth quarter	116	87	NA	199	113	118
Annual average	114	92	NA	206	118	132

NA Not available.
[1] Except as noted, quarterly figures are for the last month in the quarter.
[2] Data for January.
[3] Actual quarterly average.
[4] Data for April.
[5] Data for May.
[6] Data for October.

Source: United Nations. Bulletin of Monthly Statistics. New York, September 1968, p. xvi; June 1969, p. xvi; and September 1969, p. xvi.

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Table 16.—Nonferrous metal prices in the United States

(Average, cents per pound except where otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [4]	Tin [5]	Silver [6]
1964	23.741	31.960	13.396	13.568	157.595	129.300
1965	24.507	35.017	15.800	14.500	178.202	129.300
1966	24.500	36.170	14.915	14.500	164.070	129.300
1967	24.978	[7] 38.226	14.183	13.843	153.434	154.968
1968:						
January	25.000	([8])	13.800	13.500	147.966	198.955
February	25.000	([8])	13.800	13.500	145.632	185.474
March	25.000	([8])	13.800	13.500	145.625	218.048
April	25.000	42.189	13.800	13.500	145.238	220.275
May	25.000	42.072	12.845	13.500	143.318	237.682
June	26.000	42.096	12.800	13.500	141.700	246.405
July	26.000	41.714	12.505	13.500	141.489	231.381
August	26.000	41.701	12.300	13.500	141.841	219.455
September	26.000	41.719	12.300	13.500	147.818	220.850
October	26.000	41.711	12.588	13.500	151.288	197.283
November	26.000	41.709	12.800	13.500	162.194	201.778
December	26.000	41.712	12.800	13.500	163.702	195.929
Annual average	25.583	[9] 41.847	13.012	13.500	148.151	214.460

[1] Unalloyed ingot, 99.5 percent, delivered United States.
[2] Electrolytic copper, domestic refineries, Atlantic seaboard.
[3] Refined lead, St. Louis.
[4] Prime Western slab, f.o.b., East St. Louis.
[5] Straits tin, New York.
[6] Cents per troy ounce, 0.999 fine, New York.
[7] Based on first 8 months of 1967.
[8] Average suspended January through March.
[9] Based on April through December.

Source: Yearbook of the American Bureau of Metal Statistics. Annual Issue for the year 1968. New York, 1969, 148 pp.

Table 17.—Nonferrous metal prices in the United Kingdom

(Average, £ per long ton unless otherwise noted)[1]

Year and month	Aluminum [2]	Copper [3]	Lead [4]	Zinc [5]	Tin [6]	Silver [7]
1964	190.900	352.879	101.250	118.125	1,240.917	111.920
1965	196.000	469.875	115.000	112.900	1,414.133	111.583
1966	196.000	554.471	95.150	101.992	1,296.588	111.807
1967	199.628	417.338	83.763	100.429	1,222.458	141.977
1968:						
January	228.666	596.388	92.763	111.358	1,323.638	208.420
February	228.666	728.070	96.350	109.975	1,317.308	198.881
March	228.666	720.150	99.058	109.054	1,318.275	225.050
April	228.666	531.375	99.375	109.204	1,315.600	225.363
May	236.444	464.196	100.545	109.971	1,306.871	242.587
June	238.000	481.238	100.918	110.879	1,306.554	249.395
July	238.000	446.325	104.525	112.425	1,302.042	236.717
August	238.000	447.229	105.796	113.721	1,297.158	221.750
September	238.000	469.950	106.396	111.271	1,300.425	223.675
October	238.000	457.175	104.804	110.567	1,317.412	199.674
November	238.000	465.621	105.075	111.725	1,406.308	203.583
December	238.000	501.625	105.863	113.779	1,380.175	199.250
Annual average	233.981	528.975	101.796	111.175	1,323.863	219.529

[1] London Metal Exchange, average settlement prices.
[2] Ingots, 99.5 percent.
[3] Electrolytic wirebars.
[4] Refined pig lead, 99.97 percent.
[5] Virgin zinc, 98 percent.
[6] Standard tin.
[7] Pence per troy ounce, 0.999 fine.

Source: Yearbook of the American Bureau of Metal Statistics. Annual Issue for the year 1968. New York, 1969, 148 pp.

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Table 18.—Nonferrous metal prices in Canada

(Average, Canadian cents per pound unless otherwise noted)

Year and month	Aluminum [1]	Copper [2]	Lead [3]	Zinc [3]	Silver [4]
1964	25.42	33.342	13.418	13.566	139.962
1965	26.00	37.639	15.500	14.500	139.879
1966	26.00	44.940	14.943	14.500	139.803
1967	26.48	47.539	14.000	13.870	172.030
1968:					
January	26.50	51.000	14.000	13.500	215.823
Feburuary	26.50	51.000	14.000	13.500	201.452
March	26.50	51.000	14.000	13.500	236.529
April	26.50	51.000	14.000	13.500	237.490
May	26.50	51.000	13.091	13.500	255.750
June	27.37	51.000	13.000	13.500	260.335
July	27.50	45.250	13.000	13.500	248.457
August	27.50	45.000	13.000	13.500	235.395
September	27.50	45.000	13.000	13.500	237.000
October	27.50	45.000	13.227	13.500	211.630
November	27.50	45.000	13.500	13.500	216.583
December	27.50	45.000	13.500	13.500	210.244
Annual average	27.07	48.020	13.443	13.500	230.557

[1] Ingot, 99.5 percent.
[2] Electrolytic ingot, prompt delivery at Toronto.
[3] Producers' prices, carload quantities, communicated by Cominco, Ltd., pig lead and prime western zinc.
[4] Canadian cents per troy ounce, Cominco, Ltd., price.

Source: Yearbook of the American Bureau of Metal Statistics. Forty-Eighth Annual Issue for the Year 1968. New York, 1969, 148 pp.

Table 19.—Mineral commodity export price indexes

(1963=100)

Year and quarter	Metal ores	Fuels	All crude minerals
1965	114	101	104
1966	[1] 115	101	104
1967	109	101	103
1968:			
First quarter	112	101	103
Second quarter	107	100	102
Third quarter	107	100	102
Fourth quarter	107	100	103
Annual average	109	100	102

[1] Derived from quarterly averages.

Source: United Nations. Monthly Bulletin of Statistics. New York, June 1969, p. xix.

Table 20.—Analysis of export price indexes

(1963=100)

Year and quarter	Developed areas		Less developed areas	
	Total minerals	Non-ferrous base metals	Total minerals	Non-ferrous base metals
1965	106	129	103	146
1966	107	144	103	177
1967	105	135	102	156
1968:				
First quarter	107	156	102	192
Second quarter	104	138	102	158
Third quarter	104	136	102	152
Fourth quarter	104	139	102	150
Annual average	104	142	102	165

Source: United Nations. Monthly Bulletin of Statistics. New York, June 1969, p. xix.

Table 21.—Leading world producers of bauxite [1]

(Gross weight, thousand metric tons)

Country	1964	1965	1966	1967	1968 [p]
Jamaica	7,936	8,651	9,062	9,268	8,525
Surinam	3,993	4,360	5,563	5,466	5,572
U.S.S.R. [e] [2]	4,300	4,700	4,800	5,000	5,000
Australia	796	1,186	1,827	4,244	4,958
Guyana	2,518	2,919	3,358	3,381	[e] 2,800
France	2,433	2,662	2,811	2,813	2,800
Yugoslavia	1,293	1,574	1,887	2,131	2,072
Hungary	1,477	1,477	1,429	1,650	1,959
Greece	1,047	1,270	1,371	1,659	[e] 1,750
United States	1,626	1,680	1,824	1,680	1,691
Total	27,419	30,479	33,932	37,292	37,127
All others	5,968	6,981	6,771	7,225	7,736
Grand total	33,387	37,460	40,703	44,517	44,863

[e] Estimate. [p] Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Excludes nepheline concentrates and alunite ores.

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Table 22.—Leading world producers of aluminum[1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
United States	2,316	2,499	2,693	2,966	2,953
U.S.S.R.e	800	840	890	965	1,000
Canada	764	753	807	885	894
Japan	266	294	337	382	483
Norway	261	279	324	361	470
France	316	341	364	361	366
Germany, West	220	234	344	253	257
Italy	116	123	128	128	142
India	57	69	83	96	120
Ghana	-----	-------	-------	40	109
Total	5,116	5,432	5,970	6,437	6,794
All others	815	886	910	1,138	1,267
Grand total	5,931	6,318	6,880	7,575	8,061

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes) Compiled Sept. 30, 1969.

Table 23.—Leading world mine producers of copper[1]

(Copper content of ore, recoverable where indicated, thousand metric tons)

Country	1964	1965	1966	1967	1968 p
United States [2]	1,131	1,226	1,296	866	1,093
U.S.S.R.e	650	700	750	800	800
Zambia	632	696	623	662	665
Chile	633	606	664	664	662
Canada [2]	442	462	461	546	552
Congo (Kinshasa)	277	289	316	319	321
Peru	[2] 176	[2] 180	176	181	213
Japan	106	107	112	118	120
Philippines	60	63	74	85	114
Australia	106	92	111	92	107
Total	4,213	4,421	4,583	4,333	4,647
All others	600	623	689	684	715
Grand total	4,813	5,044	5,272	5,017	5,362

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Recoverable.

Table 24.—Leading world producers of iron ore, iron ore concentrates, and iron ore agglomerates[1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
U.S.S.R.	145,584	153,432	160,271	168,200	177,600
United States	86,198	88,842	91,594	85,530	87,248
France	60,938	59,532	55,060	49,220	55,300
Canada	34,769	36,250	36,914	38,390	44,791
China, mainland e	37,000	39,000	40,000	28,000	38,000
Sweden	26,619	29,354	27,987	28,270	32,420
India (including Goa)	21,376	23,830	26,336	26,157	27,433
Australia	5,759	6,803	11,068	17,309	26,400
Brazil	16,962	20,754	23,254	22,298	24,200
Liberia	12,999	15,959	16,859	18,224	19,571
Venezuela	15,656	17,510	17,759	17,124	16,190
United Kingdom	16,588	15,662	13,877	12,944	13,948
Chile	9,853	12,145	12,246	10,783	11,917
Total	490,301	519,073	533,225	522,449	575,018
All others	92,143	101,909	102,802	101,078	105,976
Grand total	582,444	620,982	636,027	623,527	680,994

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

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Table 25.—Leading world producers of steel ingots and castings [1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
United States	115,281	119,259	121,654	115,406	119,260
U.S.S.R.	85,088	91,021	96,907	102,224	107,000
Japan	39,799	41,161	47,784	62,154	66,892
Germany, West	37,339	36,821	35,316	36,774	41,159
United Kingdom	26,651	27,444	24,705	24,276	26,274
France	19,505	19,340	19,585	19,655	20,410
Italy	9,793	12,681	13,639	15,890	16,964
China, mainland e	14,000	15,000	16,000	11,000	15,000
Belgium	8,731	9,169	8,917	9,716	11,486
Poland	8,573	9,088	9,850	10,454	11,007
Czechoslovakia	8,377	8,598	9,124	10,002	e 10,500
Canada	8,281	9,134	9,074	8,795	10,207
Total	381,368	398,716	412,555	426,346	456,159
All others	56,326	60,045	62,516	65,886	71,393
Grand total	437,694	458,761	475,071	492,232	527,552

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

Table 26.—Leading world mine producers of lead [1]

(Lead content of ore, recoverable where indicated, thousand metric tons)

Country	1964	1965	1966	1967	1968 p
U.S.S.R. e	330	350	375	400	400
Australia	381	368	371	381	388
Canada	187	275	293	308	328
United States [2]	259	273	297	288	326
Mexico	170	167	174	164	174
Peru [2]	151	154	145	158	168
Yugoslavia	113	106	103	108	e 110
Bulgaria	91	e 100	e 100	e 103	e 106
China, mainland e	100	100	100	90	100
Total	1,782	1,893	1,958	2,000	2,100
All others	740	802	891	874	e 916
Grand total	2,522	2,695	2,849	2,874	3,016

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Recoverable.

Table 27.—Leading world producers of manganese ore [1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
U.S.S.R.	7,096	7,576	7,705	7,175	7,500
South Africa, Republic of	1,320	1,537	1,698	1,817	1,972
India (including Goa)	1,407	1,647	1,678	1,590	1,602
Brazil	1,352	1,396	1,239	941	1,426
Gabon	960	1,280	1,274	1,147	1,221
China, mainland e	1,000	1,000	1,000	700	900
Australia	62	102	318	558	749
Ghana	462	604	587	498	413
Japan	285	303	321	339	323
Total	13,944	15,475	15,815	14,765	16,106
All others	2,143	2,268	2,186	1,913	1,624
Grand total	16,087	17,743	18,001	16,678	17,730

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

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Table 28.—Leading world mine producers of tin[1]

(Tin content of ore, long tons)

Country	1964	1965	1966	1967	1968 p
Malaysia	60,004	63,670	68,886	72,121	75,069
Bolivia	24,819	23,086	25,626	26,890	28,576
U.S.S.R.e[2]	22,000	23,000	24,000	25,000	26,000
Thailand	15,597	19,047	22,565	22,489	23,678
China, mainland e[2]	25,000	25,000	22,000	20,000	20,000
Indonesia	16,845	14,699	12,526	13,597	16,563
Nigeria	8,721	9,547	9,354	9,840	9,644
Total	171,986	177,999	184,957	189,437	199,530
All others	21,471	23,116	23,114	25,569	28,051
Grand total	193,457	201,115	208,071	215,006	227,581

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes).. Compiled Sept. 30, 1969.
[2] Estimated smelter production.

Table 29.—Leading world mine producers of zinc[1]

(Zinc content of ore, recoverable where indicated, thousand metric tons)

Country	1964	1965	1966	1967	1968 p
Canada	662	826	950	1,133	1,155
U.S.S.R.e[2]	480	470	500	535	540
United States [2]	522	554	519	498	480
Australia	350	355	375	406	420
Peru [2]	237	254	258	305	309
Japan	216	221	254	263	264
Mexico	236	225	219	241	240
Poland	151	152	150	157	e 158
Italy	118	116	116	125	140
Congo (Kinshasa)	106	119	118	122	127
Korea, North e	100	105	105	115	115
Germany, West	111	109	107	115	110
China, mainland e	100	100	100	90	100
Total	3,389	3,606	3,766	4,105	4,158
All others	694	702	731	731	809
Grand total	4,083	4,308	4,497	4,836	4,967

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes).. Compiled Sept. 30, 1969.
[2] Recoverable.

Table 30.—Leading world producers of hydraulic cement[1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
U.S.S.R.	64,934	72,888	79,992	84,800	87,500
United States (including Puerto Rico)	65,728	66,318	68,522	65,807	67,806
Japan	32,981	32,689	38,265	42,993	48,009
Germany, West	33,682	34,133	34,739	31,507	33,443
Italy	22,840	20,695	22,430	26,272	29,536
France	21,537	22,365	23,804	24,400	e 25,300
United Kingdom	16,966	16,971	16,785	17,609	17,820
Spain	8,500	9,698	12,077	13,340	e 15,100
India	9,690	10,578	11,057	11,700	11,940
Poland	8,761	9,573	10,041	11,138	11,600
China, mainland e	10,500	11,000	11,000	8,000	9,000
Germany, East	5,767	6,087	6,456	7,182	7,550
Canada	7,119	7,645	8,102	7,253	7,511
Brazil	5,564	5,624	6,046	6,405	7,281
Rumania	4,752	5,405	5,886	6,388	7,026
Mexico	4,418	4,322	4,907	5,597	6,126
Total	323,689	335,491	359,609	370,341	392,548
All others	91,955	98,563	104,995	113,005	117,590
Grand total	415,644	434,054	464,604	483,346	510,138

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes) Compiled Sept. 30, 1969.

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Table 31.—Leading world producers of phosphate rock [1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
United States	23,328	26,746	35,420	36,079	37,422
U.S.S.R. e [2]	10,735	13,600	14,750	16,300	17,700
Morocco	10,098	9,824	9,439	9,945	10,512
Tunisia	2,751	3,040	3,216	2,810	3,444
Nauru Island [3]	1,849	1,496	2,037	1,798	2,254
Total	48,761	54,706	64,862	66,932	71,332
All others	8,138	9,070	10,618	11,208	12,411
Grand total	56,899	63,776	75,480	78,140	83,743

e Estimate. p Preliminary.
[1] Includes output of all major crude mineral sources of phosphate, including apatite, guano, and similar materials as well as regular phosphate rock. Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Includes material described as sedimentary rock in Soviet sources.
[3] Exports.

Table 32.—Leading world producers of marketable potash [1]

(Thousand metric tons K_2O equivalent)

Country	1964	1965	1966	1967	1968 p
U.S.S.R.	2,200	2,368	2,626	2,868	e 3,150
Canada	779	1,353	1,805	2,162	2,623
United States	2,628	2,848	3,012	2,993	2,469
Germany, East	1,857	1,926	2,006	2,206	e 2,200
Germany, West	2,201	2,385	2,291	2,131	2,220
France	1,807	1,888	1,782	1,818	e 1,719
Total	11,472	12,768	13,522	14,178	14,381
All others	698	956	1,046	1,115	1,168
Grand total	12,170	13,724	14,568	15,293	15,549

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

Table 33.—Leading world producers of pyrite [1]

(Gross weight, thousand metric tons)

Country	1964	1965	1966	1967	1968 p
Japan	4,146	4,323	4,734	4,528	4,475
U.S.S.R. e	3,200	3,300	3,300	3,500	3,500
Spain	2,393	2,424	2,418	2,291	2,403
China, mainland e	1,300	1,500	1,500	1,500	1,500
Italy	1,395	1,402	1,304	1,411	1,406
United States	861	889	886	875	886
Cyprus	685	994	804	862	874
Finland	547	582	516	712	774
Norway	719	709	677	637	688
Germany, West	424	439	450	556	615
South Africa, Republic of	432	428	481	553	704
Portugal	607	613	558	528	553
Korea, North e	420	450	500	500	500
Sweden	452	441	434	483	474
Total	17,581	18,494	18,562	18,936	19,352
All others	3,019	3,046	3,058	3,270	2,752
World total	20,600	21,540	21,620	22,206	22,104

e Estimate. p Preliminary.
[1] Includes cupreous pyrites. Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

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Table 34.—Leading world producers of elemental sulfur [1]

(Thousand metric tons)

Country	1964	1965	1966	1967	1968 p
United States	6,350	7,449	8,374	8,416	8,955
Canada (sales)	1,622	1,876	1,852	2,267	2,346
Mexico	1,725	1,586	1,706	1,891	1,685
France	1,511	1,521	1,540	1,665	1,617
U.S.S.R. e	1,350	1,430	1,430	1,500	1,500
Poland	295	431	477	[2] 722	[2] 1,316
Japan	260	250	283	316	334
China, mainland e	250	250	250	250	250
Germany, West	78	77	80	105	127
Germany, East	125	125	128	123	e 125
Total	13,566	14,995	16,120	17,255	18,255
All others	600	579	626	670	686
Grand total	14,166	15,574	16,746	17,925	18,941
Of which:					
Frasch	6,974	7,720	8,751	9,176	10,014
From sulfur ores	1,858	2,018	2,134	2,223	2,237
Other elemental recovered	5,334	5,836	5,861	6,526	6,690

e Estimate. p Preliminary.

[1] Includes Frasch process sulfur, sulfur from sulfur ores, and byproduct sulfur from other ores, natural gas, and oil industry operations, but excludes sulfur contained in sulfuric acid manufactured directly from ores and other sources without being first reduced to elemental sulfur. Moreover, insofar as possible, elemental sulfur derived from pyrite is also excluded. Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.

[2] Includes Frasch process sulfur; Poland became the third nation in the world to produce Frasch sulfur in 1967, the others being the United States and Mexico.

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Table 35.—Leading world producers of coal (all grades)[1]

(Million metric tons)

Country	1964			1965			1966			1967			1968 p		
	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total	Lignite	Bituminous and anthracite	Total
U.S.S.R.[2]	145	409	554	150	428	578	146	439	585	144	451	595	•140	•454	•594
United States	3	455	458	3	475	478	4	493	497	4	508	512	4	505	509
China, mainland •	(3)	290	290	(3)	300	300	(3)	325	325	(3)	225	225	(3)	300	300
Germany, East	257	2	259	251	2	253	249	2	251	242	2	244	247	•2	249
Germany, West	111	[4] 144	255	102	[4] 137	239	98	[4] 127	225	97	[4] 113	210	102	112	214
United Kingdom	-----	197	197	------	191	191	------	177	177	------	175	175	------	167	167
Poland	20	117	137	23	119	142	25	122	147	24	124	148	27	129	156
Czechoslovakia	76	28	104	73	28	101	74	27	101	71	26	97	•70	26	•96
India	2	62	64	2	67	69	3	68	71	3	68	71	4	69	73
Austria	19	28	47	21	32	53	22	34	56	24	35	59	23	41	64
South Africa, Republic of	-----	45	45	------	48	48	------	48	48	------	49	49	------	52	52
Japan	1	51	52	1	50	51	(5)	51	51	(5)	47	47	(5)	47	47
France	2	53	55	3	51	54	3	50	53	3	48	51	3	42	45
Bulgaria	24	1	25	24	1	25	25	1	26	26	(5)	26	29	(5)	29
Hungary	27	4	31	27	4	31	26	4	30	23	4	27	23	4	27
Yugoslavia	28	1	29	29	1	30	28	1	29	26	1	27	26	1	27
Korea, North	(3)	14	14	(3)	•18	•18	(3)	•20	•20	(3)	•21	•21	(3)	•23	•23
Total	715	1,901	2,616	709	1,952	2,661	703	1,989	2,692	687	1,897	2,584	698	1,974	2,672
All others	27	106	133	28	104	132	30	102	132	32	98	130	26	86	112
Grand total	742	2,007	2,749	737	2,056	2,793	733	2,091	2,824	719	1,995	2,714	724	2,060	2,784

• Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Excludes production from U.S.S.R.-controlled portion of Svalbard (Spitzbergen).
[3] Output small; included under bituminous and anthracite.
[4] Includes pitch coal.
[5] Less than ½ unit.

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Table 36.—Leading world producers of marketed natural gas[1]

(Billion cubic feet)

Country	1964	1965	1966	1967	1968 p
United States	15,462	16,040	17,207	18,171	19,322
U.S.S.R.	3,892	4,570	5,110	5,601	6,039
Canada	1,328	1,442	1,842	1,472	1,643
Rumania [2]	403	454	497	560	775
Netherlands	27	56	116	254	514
Italy	269	278	297	324	360
Venezuela	237	250	264	293	301
Mexico	235	250	255	276	285
Total	21,853	23,335	25,088	26,951	29,239
All others	1,014	1,145	1,306	1,458	1,793
Grand total	22,867	24,480	26,394	28,409	31,032

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Statistical series revised to exclude casing-head gas, previously included.

Table 37.—Leading world producers of crude oil[1]

(Million 42-gallon barrels)

Country	1964	1965	1966	1967	1968 p
United States	2,787	2,849	3,028	3,216	3,329
U.S.S.R.	1,644	1,786	1,948	2,100	2,252
Venezuela	1,242	1,268	1,280	1,293	1,319
Iran	619	688	771	948	1,039
Saudi Arabia	628	739	873	948	1,036
Libya	316	445	558	637	949
Kuwait	775	792	881	837	886
Iraq	462	482	505	446	550
Canada	275	296	321	351	436
Algeria	205	202	257	282	325
Indonesia [2]	171	179	168	186	220
Trucial States	67	108	132	189	182
Mexico	116	118	121	133	160
Kuwait-Saudi Arabia Neutral Zone	131	132	153	151	157
Argentina	100	98	105	115	125
Qatar	78	84	106	118	124
Total	9,616	10,261	11,102	11,900	13,089
All others	695	797	918	973	1,079
Grand total	10,311	11,058	12,020	12,873	14,168

e Estimate. p Preliminary.
[1] Includes additions and revisions to data appearing elsewhere in the 1968 Minerals Yearbook (all volumes). Compiled Sept. 30, 1969.
[2] Includes output of West Irian

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Table 38.—Major world trade in bauxite and alumina [1]

(Thousand metric tons)

Source countries	1967 production by source country [2]	1967 export by source country [2]	Recipient countries [3]											
			United States	Canada	Austria	France	West Germany	Italy	Norway	Sweden	United Kingdom	U.S.S.R.	Japan	Selected other [4]
Bauxite:														
Australia	4,244	NA	(5)	------	------	115	356	------	------	------	------	------	644	------
Dominican Republic	983	1,248	1,017	------	------	------	------	------	------	------	------	------	------	------
France	2,813	158	------	------	------	------	86	------	------	------	50	------	------	3
Ghana	351	300	------	------	------	------	44	------	------	------	278	------	------	------
Greece	1,659	1,132	22	------	------	59	327	------	34	45	92	430	3	55
Guyana	3,381	2,319	546	1,409	------	34	36	17	(5)	3	6	------	40	33
Haiti	359	NA	368	------	------	------	------	------	------	------	------	------	------	------
Hungary	1,650	668	------	------	------	------	80	------	------	------	------	------	------	------
India	789	54	------	------	------	------	18	------	------	------	25	------	2	------
Indonesia	920	NA	------	39	------	------	10	48	------	------	------	------	772	------
Jamaica	9,268	7,257	8,194	------	------	------	------	------	------	------	------	------	------	------
Malaysia	900	866	------	158	------	------	------	------	------	------	------	------	608	------
Sierra Leone	342	NA	------	------	------	------	244	107	------	------	------	------	------	------
Surinam	5,466	3,721	3,167	700	22	18	32	------	------	1	8	------	17	------
Yugoslavia	2,131	1,824	------	------	------	------	569	277	------	------	4	646	------	------
Other and not specified	9,261	NA	108	18	9	------	------	94	(5)	(5)	1	------	------	12
Total	44,517	NA	13,422	2,324	31	226	1,802	543	35	49	459	1,076	2,086	103
Alumina:														
Australia	763	NA	280	19	------	------	------	------	24	------	------	------	117	------
Canada	•1,000	NA	144	XX	------	1	------	1	------	------	1	------	------	------
France	1,024	204	34	------	4	------	1	18	4	------	3	------	(5)	142
Germany, West	741	157	(5)	------	89	------	------	2	------	5	1	------	(5)	27
Guinea	530	530	20	33	45	------	49	------	145	------	------	------	------	86
Guyana	273	273	24	105	------	------	------	------	82	38	------	------	------	42
Hungary	328	247	------	------	5	------	------	------	------	------	------	89	------	5
Jamaica	838	837	118	384	------	------	------	------	241	42	------	------	------	14
Japan	710	88	39	------	------	------	------	3	------	------	------	------	------	29
Surinam	741	685	363	------	9	------	14	------	108	------	------	------	------	86
United States	5,910	507	XX	149	------	2	2	3	96	(5)	1	53	1	13
Other and not specified	NA	NA	1	------	19	------	1	------	1	(5)	(5)	26	------	8
Total	NA	NA	1,023	690	171	3	67	27	701	86	6	168	119	452

• Estimate. NA Not available. XX Not applicable.

[1] Data presented are compiled differently from that appearing in similar tables in previous editions of this chapter; table in this edition is compiled from import statistics for countries listed as recipient countries and, as such, is incomplete, but is believed to account for the overwhelming share of total movements of bauxite and alumina. Previous editions have not taken into account the sizable movement of alumina.

[2] As reported in latest country chapter of Volume IV, Minerals Yearbook. Data on bauxite production is on dry equivalent basis for a number of countries, and as such may be reported on a different basis from bauxite exports, which almost universally are on a gross weight basis and which were obtained from the Statistical Office of the United Nations. Data on alumina production are generally for output prior to calcination, while data on alumina exports, also from the Statistical Office of the United Nations, include aluminum hydroxide and thus may not be comparable exactly.

[3] Countries selected are most of the world's significant aluminum producers that depend upon imports of bauxite and/or alumina for a significant share of their raw material requirements, plus a few minor countries for which data was readily available. Data are from the Statistical Office of the United Nations except for U.S.S.R. figures, which were obtained from official Soviet sources.

[4] Countries included are as follows: Bauxite—Belgium, Denmark, Luxembourg, Netherlands, Spain, and Yugoslavia; alumina—Australia, Belgium, Denmark, Finland, Greece, Luxembourg, Netherlands, Portugal, Spain, and Switzerland.

[5] Less than ½ unit.

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Table 39.—World trade in unrefined and refined copper by major producers in 1967

(Thousand metric tons)

Sources	Destinations				
	United States	Belgium-Luxembourg	France	West Germany	Italy
Canada	133	(1)	10	7	1
United States	XX	3	17	18	25
Chile	149	32	40	128	55
Peru	104	21	1	21	----------
Belgium-Luxembourg	22	XX	79	59	22
Germany, West	36	6	7	XX	4
U.S.S.R.[2]	----------	----------	----------	----------	----------
United Kingdom	8	2	1	15	2
Congo (Kinshasa)[3]	5	182	36	2	37
Zambia	31	3	48	31	55
Selected other countries [4]	11	9	2	12	1
Total	499	258	241	293	202

Sources	Destinations				
	U.S.S.R.	United Kingdom	Japan	Other and unspecified	Total
Canada	----------	85	4	10	250
United States	----------	24	28	86	201
Chile	----------	101	22	75	602
Peru	----------	----------	6	7	160
Belgium-Luxembourg	----------	5	1	98	286
Germany, West	----------	23	(1)	83	159
U.S.S.R.[2]	XX	3	----------	91	94
United Kingdom	----------	XX	(1)	32	60
Congo (Kinshasa)[3]	NA	4	6	[5] 3	275
Zambia	----------	167	131	107	573
Selected other countries [4]	----------	17	9	16	77
Total	NA	429	207	608	2,737

NA Not available. XX Not applicable.
[1] Less than ½ unit.
[2] Source: Trade returns of the U.S.S.R.
[3] Figures given are imports by countries listed rather than exports of Congo (Kinshasa).
[4] Australia, Austria, France, Japan, Netherlands and Sweden.
[5] Data are for Netherlands only.

Source: Except as otherwise noted, export statistics for countries listed as sources, as given in Metallgesellshaft Aktiengesellshaft. Metal Statistics 1958–67. 55th Annual Issue Frankfurt am Main, 1967, pp. 151–205.

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Table 40.—Major world trade in iron ores, concentrates, and agglomerates (excluding roasted pyrite)[1]

(Thousand metric tons)

Source country	Recorded total 1967 export of source country [2]	Recorded imports of principal recipient countries [3]					
		Canada	United States	Belgium-Luxembourg	Czechoslovakia	France	West Germany
Australia	9,162	----------	----------	204	----------	163	183
Brazil	14,279	110	1,666	195	----------	1,039	4,404
Canada	31,911	----------	24,646	----------	----------	----------	943
Chile	9,894	----------	1,387	62	----------	38	183
France	17,537	----------	----------	12,385	----------	----------	4,276
India	15,646	----------	----------	207	942	31	334
Liberia	17,252	45	3,149	1,074	----------	954	6,160
Malaysia	5,330	----------	----------	----------	----------	----------	----------
Mauritania	7,532	----------	25	1,024	----------	1,644	1,253
Norway	2,506	----------	443	62	----------	3	1,081
Peru	8,497	----------	893	----------	----------	318	17
Sierra Leone	2,217	----------	----------	12	----------	77	514
South Africa, Republic of	4,269	----------	----------	----------	----------	----------	----------
Sweden	23,057	----------	150	6,337	----------	356	10,265
U.S.S.R.	28,685	----------	----------	----------	8,690	----------	282
United States	5,391	2,283	----------	----------	----------	----------	----------
Venezuela	16,467	----------	13,025	----------	----------	----------	1,328
Other countries [4]	7,563	1	2	317	734	220	638
Total	227,195	2,439	45,386	21,879	10,366	4,843	31,861

Source country	Recorded imports of principal recipient countries [3]						
	Italy	Netherlands	Poland	United Kingdom	Other Europe [5]	Japan	Total of listed imports
Australia	169	----------	----------	93	----------	8,314	9,126
Brazil	944	938	336	753	428	2,431	13,244
Canada	1,394	619	----------	3,131	----------	1,680	32,413
Chile	----------	----------	----------	----------	----------	8,099	9,769
France	----------	----------	----------	83	----------	----------	16,744
India	17	----------	195	10	221	10,829	12,786
Liberia	2,554	948	----------	1,722	86	121	16,813
Malaysia	----------	----------	----------	----------	----------	5,218	5,218
Mauritania	1,197	68	----------	1,658	231	432	7,532
Norway	67	----------	102	638	416	----------	2,807
Peru	276	----------	----------	----------	----------	6,823	8,327
Sierra Leone	349	915	----------	212	----------	29	2,108
South Africa, Republic of	----------	----------	----------	----------	----------	4,349	4,349
Sweden	469	69	761	3,494	324	64	22,289
U.S.S.R.	297	----------	8,594	1,419	6,885	462	26,629
United States	----------	----------	----------	----------	----------	3,608	5,891
Venezuela	1,022	----------	----------	1,391	----------	----------	16,766
Other countries [4]	1,171	84	68	1,182	1,641	4,227	10,285
Total	9,926	3,641	10,056	15,781	10,232	56,686	223,096

See footnotes at end of table.

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[1] Disparities between recorded exports of source countries and totals of recorded imports of recipient countries are due to: 1. time lag between shipment and receipt, and 2. the fact that the latter totals are incomplete.

[2] Source: Official trade returns of countries listed.

[3] Source: Statistical Office of the United Nations. 1967 World Trade Annual, V. I, Walker and Company, N.Y. 1969, p. 288, except for data for Czechoslovakia, Poland, East Germany, and Rumania, which are from official trade returns of the respective countries.

[4] Recorded 1967 export column is a total of exports of the following countries: Algeria, Angola, Belgium-Luxembourg, Denmark, Finland, West Germany, Guinea, Hong Kong, Italy, North Korea, South Korea, Morocco, Netherlands, New Caledonia, Philippines (exports to Japan only), Poland, Spain, Sudan, Switzerland, Thailand, Tunisia and Yugoslavia. Recorded imports of principal recipients listed include receipts from the foregoing list of countries as well as receipts credited to the following source countries for which either: 1) no iron ore export was reported in 1967 trade returns, or 2) trade returns for 1967 were not available: China (mainland), Iran, Libya, Mozambique, Nigeria, Taiwan, and United Arab Republic. In the case of some recorded imports credited in this table to other countries, some or all of the tonnage may actually have originated in one or more of the listed source countries, but was not so reported in the source publications for this data.

[5] Includes the following countries with the indicated total import tonnages in thousand metric tons: Austria 904, Finland 638, East Germany 1,550, Greece 178, Hungary 2,808, Norway 8, Portugal 48, Rumania 3,860, Spain 598, Switzerland 17, and Yugoslavia 128.

Table 41.—Major world trade in steel ingots and semimanufactures in 1967, by areas

(Thousand metric tons)

Exporting country and area	Destinations [1]														
	North America			Europe						South Asia and Far East					
										Non-Communist					
	United States	Canada	Latin America [2]	European Economic Community	European Free Trade Association	Other Non-Communist	Communist [3]	Africa	Near East [4]	Japan	Other	Communist [5]	Oceania	Unallocated	Total
North America:															
Canada	518.9	XX	140.6	44.6	107.4	7.1	------	10.0	1.0	0.1	27.1	------	21.4	------	878.2
United States	XX	322.7	306.5	89.3	40.7	61.4	2.8	79.4	38.4	6.7	582.0	------	18.5	------	1,548.4
Total	518.9	322.7	447.1	133.9	148.1	68.5	2.8	89.4	39.4	6.8	609.1	------	39.9	------	2,426.6
Europe:															
European Economic Community:															
Belgium-Luxembourg	1,368.0	161.0	281.0	5,829.0	840.0	312.0	120.0	274.0	207.0	23.0	181.0	84.0	10.0	------	9,640.0
France	775.8	54.9	224.5	2,631.7	994.4	347.8	133.3	530.7	264.8	------	152.4	81.1	18.1	5.5	6,264.5
Germany, West	1,792.2	159.3	507.7	4,856.0	1,548.7	707.9	816.0	256.0	451.7	72.3	276.4	526.1	19.3	------	11,989.6
Italy	89.1	38.5	93.3	553.2	186.6	123.5	294.6	221.4	248.5	.1	57.7	102.6	1.5	.9	2,011.5
Netherlands	182.0	5.1	43.3	1,226.5	438.2	332.0	57.1	75.6	35.5	.2	31.4	2.2	.7	------	2,429.8
Subtotal	4,206.6	418.8	1,149.8	15,096.4	4,007.9	1,823.2	1,471.0	1,357.7	1,207.5	95.6	698.9	746.0	49.6	6.4	32,335.4
European Free Trade Association:															
Austria	10.1	2.6	21.0	530.5	212.6	31.4	332.1	3.3	31.8	.4	8.4	2.2	1.7	4.4	1,192.5
Denmark	.1	------	.3	89.5	111.6	2.1	1.2	.4	.9	------	.4	------	------	.4	206.9
Norway	7.2	.1	1.6	106.3	286.0	45.6	3.3	2.5	.8	------	.4	------	(6)	------	453.8
Portugal	(6)	------	(6)	3.5	4.7	5.2	------	25.5	5.0	.3	.1	------	(6)	------	44.3
Sweden	70.0	13.0	20.8	334.9	577.1	124.7	92.3	8.2	7.3	2.4	19.8	25.3	6.1	------	1,302.4

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Switzerland [7]	7.3	2.5	1.7	47.7	24.7	3.2	.3	2.0	.9	(6)	.3	------	.5	.2	91.3
United Kingdom	722.8	143.4	262.7	388.2	585.7	520.2	127.9	330.2	192.4	98.3	321.6	131.6	142.4	------	3,912.4
Subtotal	817.5	161.6	308.1	1,500.6	1,752.4	732.4	557.6	372.1	239.1	96.4	351.0	159.1	150.7	5.0	7,203.6
Other non-Communist Europe:															
Finland	.1	(6)	(6)	3.3	50.5	1.7	2.4	(6)	.2	------	(6)	------	------	------	58.2
Greece	(6)	------	------	3.2	1.1	.1	2.2	.1	.8	------	------	------	2.4	------	9.9
Spain	(6)	(6)	4.5	4.5	1.8	1.4	36.3	1.4	1.7	.2	------	------	------	.2	52.0
Subtotal	.1	(6)	4.5	11.0	53.4	3.2	40.9	1.5	2.7	.2	(6)	------	2.4	.2	120.1
European Communist Countries:															
Czechoslovakia	------	83.5	6.4	382.4	215.3	50.7	1,054.2	76.4	114.4	------	38.3	(6)	.9	------	2,022.5
Germany, East	------	------	1.0	102.0	28.0	3.0	257.0	17.0	20.0	------	5.0	10.0	------	[9] 213.0	656.0
Hungary	------	------	(6)	85.8	95.8	30.5	321.7	13.1	180.5	------	22.0	6.5	.1	.2	756.2
Poland	136.4	13.6	60.8	111.7	170.7	42.5	565.1	42.3	32.4	------	53.0	18.8	------	------	1,247.3
Rumania	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
U.S.S.R.	------	2.1	182.5	23.1	87.0	130.1	4,506.2	102.2	268.7	20.6	82.1	112.1	------	111.2	5,627.9
Yugoslavia	2.4	------	.2	71.5	4.5	(6)	149.3	11.0	16.7	------	7.0	------	------	------	262.6
Subtotal	138.8	99.2	250.9	776.5	601.3	256.8	6,853.5	262.0	632.7	20.6	207.4	147.4	1.0	324.4	10,572.5
Total	5,163.0	679.6	1,713.3	17,384.5	6,415.0	2,815.6	8,923.0	1,993.3	2,082.0	212.8	1,257.3	1,052.5	208.7	336.0	50,231.6
Africa: South Africa, Republic of	7.0	.1	.2	32.7	3.3	4.0	------	------	------	(6)	.1	------	.2	179.8	227.4
South Asia and Far East:															
India [10]	9.4	(6)	(6)	3.1	5.9	(6)	109.0	56.1	214.8	21.4	144.6	------	10.7	.1	575.1
Japan	4,094.0	203.0	485.0	181.0	29.0	45.0	114.0	220.0	220.0	XX	2,248.0	603.0	265.0	------	8,707.0
Total	4,103.4	203.0	485.0	184.1	34.9	45.0	223.0	276.1	434.8	21.4	2,392.6	603.0	275.7	.1	9,282.1
Oceania: Australia	141.5	15.8	13.2	57.3	86.2	98.3	------	7.9	1.2	54.3	361.8	38.6	277.9	39.3	1,193.3
Grand total	9,933.8	1,221.2	2,658.8	17,792.5	6,687.5	3,031.4	9,148.8	2,366.7	2,557.4	295.3	4,620.9	1,694.1	797.4	555.2	63,361.0

NA Not available. XX Not applicable.

[1] Because of the practice of some countries of not reporting destinations for a portion of exports (see Unallocated column, above) figures given for distribution of those countries' exports by continental area are not exactly correct. However, such unallocated quantities are sizable only in the case of the U.S.S.R., Republic of South Africa and Australia.

[2] All Western Hemisphere areas except United States and Canada.

[3] Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, U.S.S.R., and Yugoslavia.

[4] Bahrain, Cyprus, Iran, Iraq, Isreal, Jordan, Kuwait, Muscat and Oman, Lebanon, Qatar, Saudi Arabia, Southern Yeman (formerly Aden), Syria, Trucial Oman, Turkey, and Yeman.

[5] Mongolia included under Other non-Communist South Asia and Far East.

[6] Less than 50 tons.

[7] Source: Statistical office of the United Nations.

[8] Included with Communist Europe.

[9] All to non-Communist Europe, countries unspecified.

[10] Year beginning April 1967 and ending March 1968.

Source: Except where otherwise noted: United Nations Economic Commission for Europe. Statistics of World Trade in Steel, 1967, 63 pp.

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Table 42.—World trade of lead ores and concentrates [1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1967:									
United States	30.3	52.8	5.8	----------	0.3	([5])	23.2	0.1	112.5
Western Europe:									
Belgium-Luxembourg [6]	45.8	----------	29.3	----------	([5])	----------	----------	9.6	84.7
France [7]	7.0	1.5	27.7	----------	25.9	.4	14.5	----------	77.0
Germany, West	26.2	15.9	46.3	12.4	15.0	3.1	7.7	----------	126.6
United Kingdom	2.9	.9	----------	----------	----------	.1	10.8	1.02	24.9
Other [8]	----------	----------	5.2	----------	11.3	----------	----------	----------	16.5
Total	81.9	18.3	108.5	12.4	52.2	3.6	33.0	19.8	329.7
Japan	32.3	15.3	----------	----------	.8	7.1	20.4	.9	76.8
Grand total	144.5	86.4	114.3	12.4	53.3	10.7	76.6	20.8	519.0
1968:									
United States	32.6	26.5	----------	----------	.6	([5])	18.7	----------	78.4
Western Europe:									
Belgium-Luxembourg [6]	53.6	38.7	40.8	----------	----------	----------	5.7	14.8	153.6
France	1.8	17.6	28.0	----------	26.0	----------	12.0	----------	80.4
Germany, West [7]	49.6	14.7	51.6	6.7	8.7	1.4	2.8	----------	135.5
United Kingdom	7.4	----------	2.8	----------	----------	----------	21.2	17.6	49.0
Other [9]	----------	----------	7.9	----------	19.1	----------	----------	.1	27.1
Total	112.4	71.0	126.1	6.7	53.8	1.4	41.7	32.5	445.6
Japan	30.3	17.6	----------	----------	----------	15.2	14.4	.5	78.0
Grand total	175.3	115.1	126.1	6.7	54.4	16.6	74.8	33.0	602.0

[1] Imports of countries other than those listed believed small.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[5] Less than 50 tons.
[6] Data are for gross weight of ore. January through October.
[7] January through November.
[8] Includes Italy, gross weight of ore for January through October, and Austria.
[9] Includes Italy, gross weight of ore for January through August, and Austria for January through September.

Source: Monthly bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics, April 1968, v. 8, No. 4, p. 24, and April 1969, v. 9, No. 4, p. 24.

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Table 43.—World trade of zinc ores and concentrates[1]

(Thousand metric tons of contained metal unless otherwise specified)

Destination	Exporting regions								
	North America	Latin America [2]	Western Europe [3]	Eastern Europe [4]	Africa	Asia	Oceania	Origin not reported by continent	Total
1967:									
United States	262.5	188.5	6.1	----------	22.0	1.1	4.4	(5)	[6] 484.5
Western Europe:									
Belgium-Luxembourg [7]	277.3	8.5	50.0	----------	39.2	----------	17.9	56.0	448.9
France [8]	50.5	14.9	53.9	----------	46.3	3.1	1.6	----------	170.3
Germany, West	21.9	4.0	39.7	----------	2.2	5.5	----------	----------	73.3
United Kingdom	22.4	.3	----------	----------	----------	1.9	78.1	16.6	119.3
Other	25.4	.8	55.4	----------	.1	----------	11.8	.1	93.6
Total	397.5	28.5	199.0	----------	87.8	10.5	109.4	72.7	905.4
Japan	33.3	174.2	----------	.5	----------	21.5	45.4	.1	275.0
Grand total	693.3	391.2	205.1	.5	109.8	33.1	159.2	72.8	[6] 1,664.9
1968:									
United States	281.8	185.3	8.4	----------	18.2	----------	2.1	----------	[6] 495.7
Western Europe:									
Belgium-Luxembourg [7]	254.5	----------	74.6	----------	61.1	----------	----------	102.5	492.7
France	38.0	19.0	98.4	.3	33.9	----------	----------	----------	189.6
Germany, West [8]	54.4	8.9	35.0	.2	1.7	.5	----------	----------	100.7
United Kingdom	36.1	2.0	3.0	----------	----------	----------	90.4	35.2	166.7
Other	31.6	.2	64.8	----------	.5	1.5	13.6	----------	112.2
Total	414.6	30.1	275.8	.5	97.2	2.0	104.0	137.7	1,061.9
Japan	43.1	257.6	5.9	13.0	----------	32.6	51.5	5.5	409.2
Grand total	739.5	473.0	290.1	13.5	115.4	34.6	157.6	143.2	[6] 1,966.8

[1] Imports of countries other than those listed believed small.
[2] Includes Mexico.
[3] Includes Yugoslavia.
[4] Includes Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and U.S.S.R.
[5] Less than 50 tons.
[6] Reported totals, detail does not add horizontally, apparently due to rounding.
[7] Data are for gross weight of ore; January through October.
[8] January through November.

Source: Monthly Bulletin of the International Lead and Zinc Study Group, Lead and Zinc Statistics, April 1968, v. 8. No. 4, p. 25, and April 1969, v. 9. No. 4, p. 25.

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Table 44.—World movement of solid fuels in 1967 [1]

(Thousand metric tons, standard coal equivalent)

Source areas	Destinations				
	North America [2]	Caribbean America [3]	Other America [4]	Western Europe [5]	Africa
North America [2]	14,840	350	2,350	17,550	5
Western Europe [5]	80	90	75	35,360	230
Africa	---	---	---	260	1,740
Far East	---	---	---	---	---
Oceania	---	---	---	---	---
Other countries [6]	---	140	160	21,625	610
World [7]	14,920	580	2,580	74,800	2,590

Source areas	Destinations				
	Near East	Far East	Oceania	Other Countries [6]	World [7]
North America [2]	---	12,210	---	80	47,410
Western Europe [5]	10	70	---	680	36,650
Africa	---	350	10	---	2,610
Far East	---	540	---	---	540
Oceania	---	9,250	310	---	9,570
Other countries [6]	---	5,490	---	34,880	62,910
World [7]	10	27,910	320	35,580	159,700

[1] Data based on the general trade system; lignite, lignite briquets, and coke are reduced to standard coal equivalent before being included; bunker loadings are excluded.
[2] Bermuda, Canada, Greenland, St. Pierre and Miquelon and the United States.
[3] Mexico, all areas of Central America, all islands of the Caribbean, Colombia, and Venezuela.
[4] All of South America except Colombia and Venezuela.
[5] All non-Communist nations of Europe and Yugoslavia.
[6] Chiefly the Communist nations of Europe and Asia, but apparently including some other countries not identified separately.
[7] Reported totals; details do not add to listed totals because of: 1.) Inclusion in totals of quantities shipped to or received from areas not listed separately or not identified in original sources, and 2.) rounding.
Source: Statistical Office of the United Nations. World Energy Supplies 1964–67, Series J, No. 12, New York 1969, pp. 40–45.

Table 45.—World movement of crude petroleum in 1967 [1]

(Thousand metric tons)

Source areas [2]	Destinations [2]				
	North America	Caribbean America	Other America	Western Europe	Africa
North America	20,810	90	---	2,910	---
Carribbean America	36,930	65,230	5,690	26,290	---
Other America	920	250	340	220	---
Western Europe	---	---	---	810	---
Africa	5,290	2,140	1,150	128,170	1,550
Near East	14,990	1,190	9,180	229,120	13,890
Far East	3,040	---	---	100	---
Other countries	---	3,840	580	28,180	2,040
World [3]	81,970	72,740	16,950	410,800	17,480

Source areas [2]	Destinations [2]				
	Near East	Far East	Oceania	Other countries	World [3]
North America	---	80	---	---	23,890
Caribbean America	---	440	---	---	134,750
Other America	---	20	---	---	1,750
Western Europe	---	---	---	100	910
Africa	540	50	---	360	139,270
Near East	23,240	124,030	16,130	---	434,020
Far East	---	14,470	5,880	---	28,500
Other countries	---	1,880	---	23,090	54,610
World [3]	23,780	140,970	22,010	24,090	812,680

[1] Data are based on the general trade system.
[2] For details on countries included in each area, see footnotes to table 44.
[3] Reported totals; details do not add to listed totals because of: 1.) inclusion in totals of quantities shipped to or received from area not listed separately or not identified in original sources, and 2.) rounding.
Source: Statistical Office of the United Nations. World Energy Supplies 1964–67, Series J, No. 12, New York 1969, pp. 78–85.

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Table 46.—Refined petroleum fuel trade in 1967 by continental areas [1]

(Million metric tons)

Continental areas [2]	Exports	Imports	Bunkers
North America	7.64	78.81	17.93
Caribbean America	110.09	13.74	13.61
Other America	.94	4.44	1.32
Western Europe	71.27	108.70	38.72
Eastern Europe	32.92	6.78	NA
Africa	4.02	10.73	8.01
Near East	46.70	2.50	17.25
Far East	18.13	37.68	20.38
Oceania	1.29	3.54	4.03
Other countries	.02	.95	NA
World [3]	293.02	267.88	121.30

NA Not available.

[1] Apparent discrepancies between export, import and bunker totals evidently result from quantities of material en route at yearend, from incomplete data, and from differing practices from country to country in the method of reporting bunkering materials.

[2] Continental areas are the same as those used in table 44 except that Albania, Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, Rumania, and the U.S.S.R. are reported under the group term Eastern Europe.

[3] Reported totals, detail do not add because of rounding.

Source: Statistical Office of the United Nations. World Energy Supplies 1964–67. Series J, No. 12, New York, 1969, pp. 58–77.

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The Mineral Industry of Algeria

By Edgar J. Gealy [1]

In 1968 production of crude petroleum in Algeria continued its upward trend as did the production of natural gas. Nonfuel production, however, was inconsistent, but apparently somewhat greater than in 1966 and 1967. Output of iron ore and phosphate rock, both significant export mineral commodities, moved up modestly; neither appeared to have returned to previous high annual levels.

Recognition of the petroleum industry as its most important single source of revenue and foreign exchange was responsible for continued and determined efforts by the Government to extend its control over the industry and to maximize the revenues flowing to Algeria from the operations. In October Getty Oil Company and the Algerian Government signed an agreement, highly favorable to the latter, which indicates the terms the Algerian Government will seek to obtain from other foreign companies operating in the country. Nationalization of the oil industry was extended early in 1968, when the state-owned Algerian company, Société Nationale pour la Recherche, la Production, la Transport, la Transformation, et la Commercialisation des Hydrocarbures (SONATRACH), took over the marketing function in Algeria from the several private companies.

Plans for expanding Algerian gas and petroleum pipelines and for a new natural gas liquefaction plant at Skikda were formalized by contracts.

PRODUCTION

Efforts to restore former production levels in mines nationalized in 1966 continued through 1968. Difficulty in marketing Algerian iron ore continued to affect production during the year, although the traditional markets provided by the West European steel industry were generally improved.

Apparently production levels at the Djebel Onk phosphate deposit continued at about those attained in 1967. However, output at the nationalized mines, operating under the autonomous national company, Société Nationale de Recherche et d'Exploitation Minere (SONAREM), did not appear to be significantly greater than in 1967.

In 1968 crude oil production recorded a 15-percent increase over that of the previous year. Marketed natural gas increased about 15 percent over that of 1967. Estimated output of the Algiers refinery in 1968 was slightly higher than that of the previous year.

[1] Assistant to the Chief, Division of International Activities.

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Table 1.—Algeria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [2]
METALS					
Aluminum:					
Unwrought [e]	150	150	150	150	150
Semimanufactures, including alloys [e]	200	215	230	230	230
Antimony:					
Concentrate	-------	200	290	366	350
Metal content	-------	64	98	117	112
Copper:					
Concentrate	3,900	3,660	4,302	4,268	4,300
Metal content	1,092	1,025	1,076	1,067	1,050
Refined, including alloys	473	e400	e2,000	e2,000	2,000
Iron and steel:					
Iron ore thousand tons	2,739	3,132	1,762	2,570	2,700
Pig iron	3,629	6,000	e10,000	e10,000	10,000
Ingots and equivalent forms	19,792	17,000	e16,000	e17,000	17,000
Semimanufactures	26,149	27,000	e27,000	e27,500	27,000
Lead:					
Concentrate	13,602	14,922	7,000	5,708	6,000
Metal content	9,548	10,445	3,990	3,253	3,420
Refined, including alloys	1,393	1,200	1,125	1,125	1,125
Silver [3] thousand troy ounces	295	295	r110	100	100
Zinc:					
Concentrate thousand tons	64	63	25	20	20
Metal content do	35	38	12	10	10
NONMETALS					
Barite	29,633	r25,600	27,110	31,350	32,000
Cement thousand tons	785	739	659	725	730
Clay, bentonitic [e]	15,000	20,000	20,000	20,000	NA
Diatomite	20,106	16,413	15,830	18,260	18,000
Fertilizer materials:					
Phosphate rock thousand tons	73	86	119	193	200
Superphosphate do	88	80	78	78	80
Fuller's earth	52,923	59,895	44,070	38,310	40,000
Gypsum [e] thousand tons	175	175	175	175	NA
Lime do	28	e20	e18	e20	NA
Pyrite do	61	57	e50	e60	NA
Salt do	116	116	e116	e117	120
MINERAL FUELS					
Coal thousand tons	46	45	e50	e50	50
Coke (low temperature) do	40	35	e25	e25	30
Natural gas, marketed million cubic feet	29,994	65,038	72,272	76,226	87,520
Liquefied natural gas thousand 42-gallon barrels	1,082	9,272	11,214	11,000	12,500
Natural gas liquids (condensate) do	2,243	3,965	5,255	5,600	6,000
Petroleum:					
Crude do	204,711	201,754	257,122	282,200	325,064
Refinery products: [4]					
Gasoline and naphthas do	2,771	3,553	3,290	4,421	4,515
Kerosine and jet fuel do	1,168	1,530	1,373	1,596	1,635
Distillate fuel oil do	3,342	3,984	3,529	5,063	5,160
Residual fuel oil do	1,858	2,298	1,945	2,625	2,685
Liquefied petroleum gas do	448	767	748	942	960
Other unspecified do	NA	NA	NA	89	45
Total do	9,587	12,132	10,880	14,686	15,000

e Estimated. r Revised. NA Not available.

[1] In addition to commodities listed, Algeria produces other construction materials, but data on output a not available.

[2] All data estimated except for natural gas and crude petroleum.

[3] Estimated recoverable silver content of lead and zinc concentrates.

[4] Output from Algiers refinery; excludes output from Hassi Messaoud topping plant.

TRADE

Comparable trade data were available for 1965 and 1967 but were lacking for 1966. In 1967, Algeria registered a positive balance of trade with total exports valued at approximately $718 million and total imports at $639 million. Crude oil, refined products, and natural gas exports accounted for almost 85 percent of the total value of all commodity exports. France was Algeria's most important trad ing partner with a 59-percent share o both imports and exports. About 9 percen of Algerian imports originated in th United States, making that country th second largest single source area, but th United States took only an insignifican share of Algerian exports.

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Table 2.—Algeria: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965 [1]	1967	Principal destinations, 1967
METALS [2]			
Copper:			
Ore and concentrate	1,100	245	All to France.
Metal, including alloys, all forms	2,673	1,588	France 393; Italy 247; Bulgaria 240.
Iron and steel:			
Ore and concentrate—thousand tons	1,647	345	Bulgaria 127; Italy 87; Greece 50.
Semimanufactures	144	3,054	Bulgaria 3,012.
Scrap	20,922	23,070	Japan 21,750.
Lead:			
Ore and concentrate	11,557	6,636	Greece 3,230; Italy 2,806; Bulgaria 600.
Metal, including alloys, all forms	573	1,017	Italy 625; France 392.
Zinc:			
Ore and concentrate	54,496	13,275	France 5,310; Poland 5,200; Italy 2,162.
Metal, including alloys, all forms	136	1,782	Italy 1,718.
NONMETALS			
Barite and witherite	11,946	29,200	Nigeria 5,700; Cameroon 1,500.
Cement—thousand tons	225	63	Spain 59.
Diatomite	7,350	6,789	France 2,609; United Kingdom 1,729.
Fuller's earth	14,538	12,477	France 6,737; Nigeria 3,631.
Phosphate rock—thousand tons	62	88	India 32; United States 15; France 10.
Pyrite	38,856	12,800	Italy 11,300; France 1,500.
Salt and brines	60,885	45,173	France 33,000; Ivory Coast 6,941; Senegal 4,964.
MINERAL FUELS			
Liquefied natural gas—thousand 42-gallon barrels	9,272	e 12,000	Mainly to France.
Petroleum:			
Crude—do	171,719	278,031	France 166,275; West Germany 46,086; Switzerland 15,589.
Refinery products:			
Gasoline—do	411	978	United Kingdom 405; Netherlands 366; Belgium-Luxembourg 161.
Kerosine and jet fuel—do	415	573	United Kingdom 110; Spain 108; Morocco 75.
Distillate fuel oil—do	110	233	United Kingdom 132; Netherlands 65; France 24.
Residual fuel oil—do	1,599	2,616	France 1,109; United Kingdom 278; United States 272.
Liquefied petroleum gas—do	30	110	Spain 98.

e Estimate.
[1] Comparable data for 1966 not available; data for 1965 revised.
[2] Includes unwrought, semimanufactures, and scrap, unless otherwise specified.

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Table 3.—Algeria: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1965 [1]	1967
METALS [2]			
Aluminum, metal including alloys, all forms		1,475	1,345
Copper, metal including alloys, all forms		2,410	1,854
Iron and steel:			
Scrap		6	19
Pig iron, ferroalloys, similar materials		657	644
Semimanufactures		66,544	45,737
Lead:			
Ore and concentrate		8	48
Oxide		15	103
Metal, including alloys:			
Unwrought		1,613	1,642
Semimanufactures		150	83
Silver, metal, including alloys	troy ounces	18,889	e 8,160
Tin, metal including alloys, all forms	long tons	56	67
Titanium oxide		307	238
Zinc:			
Oxide		251	290
Metal including alloys:			
Unwrought		152	150
Semimanufactures		404	314
NONMETALS			
Asbestos		1,968	1,826
Cement		9,820	11,494
Chalk		3,009	4,105
Clays		1,870	8,189
Dolomite		342	679
Fertilizer materials:			
Crude:			
Nitrogenous		302	312
Other		181	499
Manufactured:			
Nitrogenous		68,975	68,737
Phosphatic		15,783	12,564
Potassic		28,037	14,306
Other, including mixed		1,118	500
Lime		3,268	2,586
Pigments, mineral, including processed iron oxides		643	418
Quartz and quartzite		506	10
Salt		63	41
Sulfur, elemental, all forms		42,363	23,582
Talc, steatite, soapstone, pyrophyllite		6,687	1,819
MINERAL FUELS			
Asphalt and bitumen, natural		1,140	5
Coal, all grades, including briquets		38,033	51,990
Coke and semicoke		20,199	4,707
Petroleum:			
Refinery products:			
Gasoline	thousand 42-gallon barrels	5	37
Kerosine	do	3	1
Jet fuel	do	--------	59
Distillate fuel oil	do	28	26
Residual fuel oil	do	57	18
Liquefied petroleum gas	do	9	102
Lubricants	do	61	225
Mineral jelly and wax	do	34	20
Other	do	15	308
Total	do	207	796
Mineral tar and other coal, petroleum, or gas derived crude chemicals		2,122	3,119

e Estimate.
[1] Comparable data for 1966 not available; data for 1965 revised.
[2] Includes unwrought, semimanufactures, and scrap, unless otherwise specified.

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COMMODITY REVIEW

METALS

Iron Ore.—Although statistical informa-ion was lacking in 1968, the Algerian iron re industry appeared to recover somewhat rom the lows of 1966 and 1967. In 1966, ationalization retarded output, and in 967 uncertain conditions in the West uropean iron ore markets resulted in arketing difficulties for Algerian mines. y 1968, operations at Ouenza-Boukhadra, lgeria's largest iron mine, picked up and his property accounted for most of the ncreased output during the year. Smaller ines were having considerable difficulty marketing their production as their ores ere not generally acceptable because of w iron content and deleterious material. n the latter part of April 1968, Algeria greed to ship 600,000 tons of iron ore to he U.S.S.R. This provided a market for me of the smaller properties.

Barter contracts, such as those made with talsider and Siderexport of Italy and everal Japanese firms, exchanging Algerian on ore for Italian and Japanese gasoline ipe, provided support for iron ore produc-on through 1968.

Results of the investigation of an iron eposit at Gara Gjebilet were not released uring 1968. Although relations between lgeria and Morocco improved during 968, exploitation of this interior deposit till faced problems of long transport routes, igh development costs, and high phos-horous content of the potential ore.

Iron and Steel.—Development of the nnaba iron and steel complex moved loser to realization in November, when a est run was made of the new oil pipe acility. The pipe mill is one of the four nits in the planned complex. The other nits consist of a smelter for the produc-on of pig iron, financed by the French; steel plant, equipped by the Soviets; and rolling mill, financed by Italian credits.

The new pipe mill was to be in full peration early in 1969. Designed by a rench firm and constructed by a West erman company, the plant uses imported teel strip (skelp) to produce a spiral elded pipe. Capacity is rated as 100,000 ns per year of 16-inch to 40-inch pipe quating to about 40 kilometers of pipeline er month depending upon the diameter.

At the ceremonies marking the first pipe production at the new facility, a government spokesman remarked that although it had been planned to have the steel plant and mill in operation about 1970, the construction schedule was delayed by 15 months, primarily because of the failures by both domestic and foreign suppliers to meet material delivery dates.

Lead and Zinc.—Société Nationale de Siderurgie (SNS) planned to erect a 40,000 ton per year electrolytic zinc plant at Ghazaquat which would use ores from the El Abed mine. Information was not available regarding the construction of a flotation plant on the Algerian side of the Algeria-Morocco border to treat production from El Abed; however, the U.S.S.R. had offered to construct such a facility. There has been some question as to the extent of known reserves at the property available to justify investment in the processing facilities. The El Abed mine, in which both Newmont and St. Joseph Lead held minority interests, was nationalized in 1966. Other partners before nationalization were represented by French and Moroccan interests, and after nationalization treatment facilities located in Morocco were denied to the mine.

Mercury.—The mercury deposit near Ismail, located by Soviet geologists, was reported to contain 277,000 tons of ore. Plans were made in 1968 to develop the deposit and erect a mercury refinery near the deposit. The construction of the refinery by the U.S.S.R. was to begin in early 1969, Algerian personnel to operate the plant were to be trained in the Soviet Union. Upon completion, the refinery is scheduled to produce over 300 tons (about 8,700 flasks) of mercury annually.

NONMETALS

Fertilizer Materials.—Estimates of phosphate rock production at Djebel Onk in 1968 appeared to be overoptimistic, as prolonged difficulty in bringing the calcining plant into operation held down output. There were indications of some improvement in 1968; however, problems developed in shipping export material from the port. Operations at the El Kouit mine which is nearing depletion appeared to continue at about a 60,000-ton-per-year level. Both mines shipped through the port of Annaba

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and were troubled by the shipping difficulties.

Construction continued at Arzew on the nitrogenous fertilizer plant. Late in October, the Government reported the facility as 60-percent complete and estimated the plant would be in production in early 1969. The cost of the Arzew fertilizer complex was estimated at $30 million.

Domestic production of superphosphates was reported to have consumed about half of the output of phosphate rock and apparently was over 100,000 tons in 1968.

Pyrite.—Although production of pyrite from the El Halia mine declined during 1965–67 owing to depletion of reserves on levels 67 and 81, development of 300,000 tons of reserves on the newly opened level 52 appear to have increased the life of the operation. This may have resulted in higher output in 1968.

MINERAL FUELS

Petroleum.—Crude oil production increased to about 890,000 barrels per day in 1968. Three companies, which accounted for slightly over 70 percent of the total output, increased production over the 1967 levels but at varying rates. Compagnie Francaise des Petroles (Algérie) (CFPA), which recorded an output increase of 24 percent in 1968, moved to a position approximating that of Compagnie de Recherches et d'Exploitation du Pétrole au Sahara (CREPS), which recorded only a 2-percent increase in production. The primary producer, Société Nationale de Recherche et d'Exploration des Pétroles en Algérie (SNREPAL), maintained its production with an 18-percent production rise. With the exception of Sinclair, most of the other significant producers reported modest production declines during 1968.

Early in 1968, Shell-Algerie, Total Algerie, Beryl Algerie, Compagnie Africaine des Raffineries de Berre, Compagnie Algerienne de Petroles Mory, Société Mediterranéene de Combustibles, Algero-Naphte, Butzgaz, Primagaz, and Raffigaz, all companies marketing in Algeria, were informed by the Government of its desire to set up a state marketing monopoly in 3 months. The companies were asked for offers to the Government as to the compensation to be paid for their assets. Prior to a reply, the Algerian Government nationalized all the foreign companies. Together with the marketing facilities of British Petroleum Esso, and Mobil, bought or nationalized previously along with refining interests, the Algerian Government established, under SONATRACH, the previously announced domestic monopoly.

About midyear, the Algerian Government banned export shipments of crude oil at what it considered fictitiously low prices. Prices considered abnormally low were in the $1.56 to 1.60 per barrel range. This interdiction struck hard at the French controlled companies as they were exporting to France in the price range mentioned. The price of crude oil was significant in the negotiations between Algeria and the French companies, as it had an impact on the amount of money repatriated for re investment in Algeria.

Toward the end of 1968, Algeria was preparing to ask France to renegotiate the fiscal terms of the Franco-Algerian accord on oil reached in 1965. Under the old pact, the French companies repatriated to Algeria 50 percent of their sales revenues and it appears certain the Algerian Government will ask that this proportion of repatriation be increased. Already, in 1968 Algeria has required an increase in the posted prices assigned to the French companies, although these are not used in determining taxes or repatriation funds.

In October, agreements were signed between Getty Oil, the Algerian Government, and the state-owned oil company (SONATRACH) which were highly advantageous to Algeria. The public announcements indicated that the Algerian Government considered the terms of the Getty agreements as a model for all foreign participation in the Algerian oil industry. Under the agreements, Getty Oil will transfer to SONATRACH 51 percent of its producing interests and will engage in a new exploration project with SONATRACH on 4,500 square miles of new acreage. The producing interests of Getty Oil consisted of its 11.5-percent interest in the output of the Rhourde el Baguel field, a share of the pipeline spur from this field, and a small interest in the Massdar oil discovery. SONATRACH will pay for the transfer of these assets by selling back to Getty Oil the crude oil to which it will be entitled by the 51-percent interest at market prices (probably about $1.85 per barrel). In the joint exploration venture SONATRACH will hold 51 percent, while

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Getty Oil will make a nonrepayable $2.25 million advance and invest at least $16 million over the next 5 years as the total cost of the exploration program. If oil is discovered, SONATRACH will make up its part of the investment on an annual basis up to 25 percent of its share of the crude oil produced. If requested, Getty Oil will buy SONATRACH's share of the crude at the average price Getty Oil receives for its crude on the market.

In the event gas is discovered, Getty will relinquish all rights (presumably to gas) to SONATRACH. Getty Oil also agreed to high posted prices for crude oil which will be $2.65 per barrel f.o.b. at Arzew, $2.635 at Bougie, and $2.595 at La Skhirra, Tunisia. Tax reference prices for Getty are $2.21 Arzew, $2.195 Bougie, and $2.155 La Skhirra. French companies' tax reference prices are $2.05, $2.08, and $2.04, respectively, so that the implication of the Getty agreement for the 1969 Franco-Algerian negotiations is clear. Getty also agreed to repatriate 75 percent of its sales revenue to Algeria as against the French 50-percent rate.

Work was begun on the Mesdar-Skikda, 36-inch crude oil pipeline, contracted in 1967 to the Italian firm, Snam Progetti. Another new line to run from Hassi Messaoud to Arzew was contracted by a British firm, at a cost estimated as about $50 million. The line is to be a combined liquified petroleum gas (LPG) and condensate carrier; LPG would be carried from Hassi Messaoud as far as Hassi R'Mel gasfield, where the condensate from the latter field would be picked up. The products would be separated at Arzew prior to export. Production of natural gas liquids (condensate) at Hassi R'Mel is slated to increase sharply, when the field is tied to the new natural gas liquefaction plant to be built at Skikda.

Natural Gas.—Production of natural gas increased markedly in 1968 based upon marketed gas data. Considerable quantities continued to be flared at Hassi Messaoud which were not measured or accounted. Late in 1968, a contract was signed with Technip of France and the Algerian Government for construction of a new natural gas liquefaction plant at Skikda; Algeria was represented by Société Mixte Algérienne de Gaz (SOMALGAZ). The plant will consist of three units and will have a combined capacity to handle almost 159 million cubic feet of gas annually. Tied into this contract was the construction of two new vessels to carry the liquefied natural gas, one to sail under the Algerian flag and the other under the French flag.

Originally the plant and the supply network of pipelines was to be completed by 1971, but the target was moved back to 1972. Algeria had not signed up markets for the liquefied natural gas (LNG) as of the end of 1968, but negotiations were underway with Canada, Italy, and Spain. Late in 1968 a tanker carried 5,000 tons of LNG to Boston in the United States to relieve an emergency shortage; this indicates that Algerian LNG may move to the U.S. market under contract in the future. Under the new agreement, the Skikda plant will extract the ethane, butane, and propane for retention in Algeria and will liquefy for export only the remaining methane. A petrochemical complex is being planned for Skikda in addition to the one under construction at Arzew. With the announced delay of the Skikda LNG facility to 1972, it is unlikely that the third liquefaction plant and network reported being considered for Arzew will move beyond this stage in the near future.

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The Mineral Industry of Angola, Mozambique, and Portuguese Guinea

By Eugene R. Slatick [1]

ANGOLA

Angola's economy remained predominantly agricultural in 1968, but minerals became increasingly important. There was a high level of activity in the established mineral industries and an interest in other mineral resources.[2] Portugal's Third Development Plan (1968–73) provides for spending $888 million [3] in Angola, including about $406 million to develop the mineral sector of the economy. According to the plan, the main minerals to be sought are petroleum, iron ore, coal, phosphate rock, copper, mica, tin, and tungsten.[4] The future economic development of Angola appears to lie mainly in the mineral industry, particularly in petroleum and iron ore. In 1968 these two commodities together with diamond continued to be the most important minerals. The labor force of the mineral industry in 1968 totaled an estimated 32,000, including about 29,000 in the diamond industry.

PRODUCTION AND TRADE

Mineral production in 1968 was valued at $110.7 million, up from about $78 million in 1967. Diamond accounted for $56.3 million, compared with $41.2 million in 1967. Continuing to rank second were petroleum products, which were valued at $18 million as compared with $14 million in 1967. The value of iron ore production rose sharply from about $5 million in 1967 to $16.3 million in 1968, supplanting crude oil as the third-ranking mineral by value. Crude oil production increased in value to $12.4 million, compared with $8.9 million in 1967.

By value, diamond remained the chief mineral export in 1967, accounting for $42 million as compared with about $39 million in 1966. Two other major mineral exports were iron ore, $5.7 million, and residual fuel oil, $3.9 million. The chief mineral imports in 1967 were iron and steel semimanufactures, $17.2 million; distillate fuel oil, $2.4 million; lubricants, $2.2 million; and fertilizer materials, $1.3 million. The values of mineral trade and total trade for recent years follow:

[1] Foreign minerals specialist (petroleum), Division of International Activities.

[2] Glad, A. L. Minerals Industries—Developments and Outlook. State Department Airgram A–56, May 13, 1969, 6 pp. (This report provided information for several parts of this subchapter.)

[3] Where necessary, values have been converted at the rate of 1 escudo (Esc.) equals US$0.035.

[4] Journal of Commerce. V. 298, No. 21,821, Nov. 26, 1968, p. 11.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	45	202
1966	49	224
1967	54	239
Imports:		
1965	16	197
1966	23	210
1967	28	276

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Table 1.—Angola: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Gold, metal—troy ounces	7	2	--	--	9
Iron, ore and concentrate—th usand tons	899	815	791	1,154	3,218
Manganese, ore and concentrate, gross weight	--	--	18,550	33,180	9,150
NONMETALS					
Cement, hydraulic—thousand tons	214	245	264	279	312
Diamond:					
Gem—thousand carats	874	r 887	r 968	983	1,316
Industrial—do	275	r 268	r 300	306	351
Total—do	1,149	1,155	1,268	1,289	1,667
Salt, marine—thousand tons	81	59	61	78	72
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	44,345	22,872	29,916	27,043	30,608
Coal, all grades	--	--	10,770	NA	--
Natural gas, associated [1]—million cubic feet	30,018	41,413	70,124	22,594	NA
Petroleum:					
Crude oil—thousand 42-gallon barrels	6,585	4,784	4,560	3,880	[2] 5,401
Refinery products:					
Motor gasoline—do	475	r 474	585	497	560
Jet fuel—do	239	296	353	339	375
Kerosine—do	46	54	55	57	64
Distillate fuel oil—do	1,930	2,172	977	799	1,010
Residual fuel oil—do	949	1,156	2,277	2,415	2,361
Liquefied petroleum gas—do	72	88	101	102	111
Asphalt and bitumen—do	44	63	66	46	63
Total—do	3,755	r 4,303	4,364	4,255	4,549

r Revised. NA Not available.
[1] Mostly flared; some used in oilfield operations.
[2] Includes production from Cabinda.

COMMODITY REVIEW

Metals.—*Copper.*—Copper has not been mined since 1963, when it was produced at Mavoio by Empresa do Cobre de Angola. In 1968 the company reportedly was considering beginning operations again, but no specific area was mentioned. Funds for prospecting for copper were provided in the Third Development Plan.

Gold.—During the year, Companhia Mineira do Lobito studied ways to exploit the gold deposits on its concession near the South Cassinga iron ore mine. A large gold deposit reportedly was found near Malanje; detailed information was not available.

Iron Ore.—In the Cassinga area, iron ore reserves averaging 60 to 65 percent iron total at least 125 million tons, which consist of 95 million tons of pebble (alluvial) ore and 30 million tons of massive hematite ore. Banded hematite-quartzite ores at Cassinga have a tenor of 35 to 53 percent iron and total an estimated 2 billion tons. The recently discovered reserves at Cassala-Quilungo, near Dondo, are low grade and total 500 million tons. Reserves at Cuima evidently are depleted. Other ore bodies not yet evaluated in detail are hematite-magnetite deposits (65 percent iron) near Andulo, north of Silva Porto, and titaniferous magnetites (48 percent iron, 26 percent titanium oxide) near Chitado, along the southern border.

During the year only the Cassinga deposits were worked by Companhia Mineira do Lobito. The company, however, exported 33,605 tons of ore from stockpiles at Cuima,[5] where operations stopped in late 1967. The pebble deposits at North Cassinga were worked throughout the year. Late in the year the massive ore deposits at South Cassinga were worked, and a 2,000-ton-per-year treatment plant began operations near Tchamutete. As mining continues at North Cassinga, the pebble ore from outlying deposits will be transported to the beneficiation plant at Jamba by a long conveyor system, which is expected to be operating in 1969. The pebble deposits are estimated to last for about 15

[5] Mining Journal (London). Mining Annual Review. June 1969, p. 295.

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Table 2.—Angola: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, scrap	16	20	All to Belgium-Luxembourg.
Copper, metal, scrap	304	18	Belgium-Luxembourg 10; West Germany 8.
Iron and steel:			
Ore and concentrate	626,792	780,619	Japan 542,582; West Germany 227,673; United Kingdom 10,363.
Metal:			
Scrap	103	9,709	Japan 9,708.
Semimanufactures	1,850	1,572	Portugal 1,389; Spain 58.
Lead, metal, scrap	218	295	Republic of South Africa 231; Belgium-Luxembourg 40.
Manganese, ore and concentrate	5,765	18,105	Japan 11,605; Italy 1,500.
Zinc, all forms	18	-------	
Ores metallic, n.e.s	1	1	Republic of South Africa 1.
NONMETALS			
Cement	87,157	22,181	Spain 8,925; Cape Verde 6,475.
Clay and clay products, including refractory brick: Brick tile, etc.	59	-------	
Diamond----thousand carats	1,264	1,316	All to Portugal.
Fertilizer materials, mineral	1,672	1,375	Portugal 704; Italy 671.
Gypsum and anhydrite	5,703	9,642	Mozambique 9,630.
Pyrite, roasted	5,766	-------	
Salt	34,516	30,565	Congo (Kinshasa) 13,147; Mozambique 6,976; Southern Rhodesia 6,892.
Stone, sand and gravel:			
Dimension stone:			
Granite	1,752	2,941	West Germany 946; Belgium-Luxembourg 783; Portugal 780.
Marble	490	862	Portugal 767; Mozambique 95.
Sand	-------	3	All to foreign ships.
Nonmetallic minerals n.e.s	13	23	Portugal 15; United Kingdom 6.
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke and briquets	-------	3	All to foreign ships' bunkers.
Petroleum refinery products:			
Gasoline---thousand 42-gallon barrels	2	3	Foreign bunkers 2.
Fuel oil [1]----do	1,262	2,010	Portuguese ships 1,032; Portugal 492; Foreign ships 410.

[1] Includes small amount of distillate fuel oil.

years, after which the hard-rock ore bodies will have to be worked.[6] During the year Lobito negotiated for contracts to export ore to Japan and several European countries. Two reports[7] about the Cassinga deposits were published during the year. The port of Moçâmedes, the outlet for iron ore from Cassinga, was renamed Port Salazar.

Late in the year, Portugal's Siderurgica Nacional announced plans to build a steel plant with an annual capacity of 90,000 tons of pig iron and 120,000 tons of steel. The plant would obtain power from the power station at Cambambe and use iron ore from Cassinga.

The Cassala-Quilungo deposits are to be developed by Companhia do Manganes de Angola at a cost of about $300 million. Tests have indicated that the ore could be concentrated to about 65 percent iron. A German company, Klöeckner Industrie-Anlagen G.m.b.H., was studying the feasibility of building a pelletizing plant with a capacity of 1.5 million tons per year.

Nonmetals.—*Cement.*—Cement continued to be produced by two companies: Companhia de Cimento Secil do Ultramar (Secil), which has a 300,000-ton-per-year plant in Luanda, and Companhia de Cimentos de Angola, which has a 90,000-ton-per-year plant in Lobito. These two plants satisfy the domestic demand for cement. Secil plans to double its capacity by about 1972.

Diamond.—In 1968 Companhia de Diamantes de Angola (DIAMANG), the country's only diamond producer, had a record production of 1,667,187 carats, a

[6] World Mining. V. 4, No. 13, December 1968, p. 53.

[7] Hood, J. C. and Korpershoek, H. R. Proving Reserves and Mine Planning of the "Pebble" Deposits at Cassinga Iron Ore Mines, Angola. Trans. Inst. Min. and Met. v. 77, July 1968, Section A, pp. A89–A102.

Metal Bulletin. Iron Ore Fields of the World: Number Thirty Seven. Cassinga of Angola. No. 5347, Nov. 8, 1968, pp. 19, 22–24, 32.

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Table 3.—Angola: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal	603	651
Copper, metal	540	414
Iron and steel:		
Oxide and hydroxide	91	122
Metal:		
Scrap	108	45
Pig iron and ferroalloys	1,862	393
Ingots and other primary forms	1,645	3,508
Semimanufactures	54,830	81,131
Lead:		
Oxide	43	27
Metal	190	299
Mercury, 76-pound flasks	7	16
Platinum, troy ounces	32	NA
Silver, do	5,282	18,275
Titanium oxide	143	198
Tin, long tons	50	66
Zinc:		
Oxide	36	52
Metal	150	332
Metallic ores and concentrates, n.e.s	2	16
Metallic compounds, n.e.s	11	5
Metals, precious, colloids, amalgams and salts, kilograms	192	NA
Metals, n.e.s	7	11
NONMETALS		
Abrasive materials:		
Mineral, including pumice	8	12
Grinding wheels and stones	10	55
Asbestos	1,352	1,447
Barite	1	2
Borates, natural	1	------
Cement	3,178	9,669
Chalk	428	368
Clay and clay products (including refractory bricks):		
Mineral	827	3,374
Brick, tile, etc	702	164
Refractory brick, tile, etc	1,815	195
Diatomite	130	180
Dolomite, calcined	29	43
Feldspar	15	45
Fertilizer materials: Manufactured:		
Nitrogenous	9,081	9,628
Phosphatic	4,880	5,892
Potassic	2,255	1,919
Mixed	2,900	4,025
Ammonia	40	74
Other	2,900	------
Graphite	2	1
Gypsum and anhydrite	218	181
Lime and limestone	31	106
Magnesite	------	5
Mica, unworked and worked	5,995	34
Pigments, mineral	41	38
Potash, caustic	4	61
Salt	91	44
Soda, caustic	1,532	2,756
Stone, sand and gravel:		
Dimension stone:		
Crushed or broken	217	284
Granite	1	1
Marble	594	361
Sand	2	15
Sulfur:		
Elemental	84	252
Dioxide	9	11
Sulfuric acid	1,595	2,333
Talc and steatite	83	133
Nonmetallic minerals, crude, n.e.s	1,086	120
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	45	132
Coal and briquets	32,151	19,861
Coal tar and other distilled products	131	120
Coke and semicoke	630	552
Petroleum, refinery products:		
Gasoline, thousand 42-gallon barrels	58	62
Kerosine, do	48	57
Distillate fuel oil, do	215	531
Lubricants, do	94	97
Liquefied petroleum gas, thousand 42-gallon barrels	(1)	20
Other, do	31	2
Total, do	446	769

NA Not available.
[1] Less than ½ unit.

29-percent increase over that in 1967.[8] Gem-quality diamond comprised approximately 79 percent of total production, compared with about 76 percent during previous years. The volume of overburden removed in 1968, largely with mechanical excavators, totaled 14.6 million cubic meters, including 1.9 million cubic meters from areas being developed. The gravel treated totaled 2,968,662 cubic meters (2,764,696 cubic meters in 1967) and had an average grade of 0.55 carat per cubic meter (0.46 carat in 1967). New diamond reserves were found in several areas.

At yearend the company placed a second heavy-liquid concentration unit in operation. Its capacity of 125 tons of gravel per hour is more than double that of the existing unit. The first two units of a series of small washing plants, also using heavy liquids, began operations. They are intended for use in areas where local conditions are unsuitable for setting up large units.

During the year, DIAMANG successfully prospected with a rotary drill adapted so that the cuttings could be collected (reverse circulation).[9] After using an 8-inch-diameter pilot bit, the rig used a 62-inch-diameter bit to drill to depths

[8] Companhia de Diamantes de Angola. Report and Balance Sheet for Year Ending Dec. 31, 1968, pp. 2–6.
[9] Mining Magazine. V. 118, No. 3, March 1968, pp. 172–173.

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ranging from 115 to 215 feet. The large-diameter holes, which were drilled over a large area, were considered necessary in order to determine a reliable carat-to-waste material ratio.

Preparations were underway during the year to grant diamond prospecting concessions to Anchor Diamond Corporation of South Africa,[10] which will establish a company jointly with the Portuguese Government, and to Companhia de Diamantes Oeste Angola, Oestediam, which was being established as a joint venture between the Government and U.S. interests. DIAMANG's present contract with the Government will expire in 1971 and be up for negotiation.

Phosphate Rock.—Late in the year a concession covering about two-thirds of Cabinda was granted to Companhia dos Fosfatos de Angola, a recently created company comprised of Portuguese interests and Pickands Mather and Company, a United States firm. Phosphate rock deposits in Cabinda are estimated at 15 million tons; those in the Zaire District in northwestern Angola are estimated at 12 million tons.

Sulfur.—At yearend Tenneco Angola, a subsidiary of Tenneco, Inc., was granted a 1,085-square-kilometer concession along the southwest coast of the Benguela Basin. Exploration for large sulfur deposits (mineral rights also include gypsum and anhydrite) was scheduled to begin in February 1969. Outcrops of sulfur have been found on favorable geologic structures. If commercially exploitable deposits are found, the sulfur will be piped to Lobito for export.

Mineral Fuels.—*Petroleum.*—Angola's petroleum reserves in 1968 were as follows: Crude oil, 500 million barrels (including 450 million barrels in Cabinda); natural gas, 625 billion cubic feet (500 billion cubic feet in Cabinda).[11]

Crude oil production during the first half of 1968 averaged 7,165 barrels per day (b/d),[12] but by yearend it rose to 14,797 b/d largely because of the start of production in Cabinda. Production in Cabinda is expected to average 40,000 b/d in 1969. Cabinda Gulf Oil Co., whose concession covers most of the enclave, found the large oil deposit offshore in mid-1966, after about 9 years of exploration. Cabinda's crude oils have a low sulfur content and have gravities ranging from about 26° API to 36° API. The first onshore oil deposit in Cabinda was found in May 1968.[13]

Elsewhere in Angola, the most promising discovery in 1968 was the North Quenguela field, about 30 kilometers southeast of Luanda on the concession held jointly by Companhia de Petróleos de Angola (PETRANGOL) and Sociedade Portuguesa de Exploração de Petróleos (ANGOL). Production from the field, which was being developed during the year, is expected to offset the declining output from the large Tobias field.

Near yearend, Cabinda Gulf Oil Co. and the Portuguese Government modified Gulf's concession contract of December 1966. The modifications increase the concession rent, establish a temporary oil export tax, and provide for advances on the company's future financial obligations. In addition, the new terms allow the company to retain the concession areas it was to relinquish at the end of 1968. The areas would have totaled 25 percent of the initial concession area.

In April, Compagnie Française des Petróles (CFP) acquired a 50-percent interest in the concessions held by ANGOL. CFP will be the operator in 7,500 square kilometers, mostly offshore, in the Ambriz area and in 15,300 square kilometers in the Cuanza area, near Luanda.

At yearend 1968, Texaco Petróleos Angola was completing negotiations to obtain exploration interests in ANGOL's offshore concession in the north, and in ANGOL–PETRANGOL's jointly owned concession in the north, which is mainly on land. Several other companies sought concessions during the year.

PETRANGOL announced plans to raise the capacity of its refinery at Luanda from the present 14,000 b/d to 20,000 b/d.[14] ANGOL reported plans to build a 12,500-b/d refinery at Lobito by 1970.

[10] Mining Journal (London). V. 270, No. 6929, June 7, 1968, p. 470.
[11] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 103.
[12] Pages 109–110 of work cited in footnote 11.
[13] The Standard Bank of South Africa, Ltd. (Johannesburg). Supplement to The Standard Bank Review. Angola: An Economic Survey. September 1968, pp. 9–10.
[14] Page 157 of work cited in footnote 11.

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MOZAMBIQUE

The mineral industry continued to have a minor role in Mozambique, a largely agricultural country. Petroleum and iron ore were the centers of interest in 1968. Work began on the dam and hydroelectric facilities at the Caborra-Bassa Gorge on the Zambeze River. The project is expected to advance the development of mineral resources in the Zambeze River Valley, which is claimed to contain economic deposits of a variety of minerals. The powerplant is expected to permit economic production of aluminum and electrolytic copper, and to encourage the building of a steel plant. The project will also result in the improvement of transportation routes to the area.

Portugal's Third Development Plan (1968–73) gives Mozambique about $227 million,[15] of which about $1 million is for developing the ilmenite deposits at Pebane, and $420,000 is for regional prospecting for other minerals.

During the year the Portuguese Government granted Messina (Transvaal) Development Co., Ltd., a 2-year exploration concession in the Rio Púngue region, west of Beira. Mineral rights cover bauxite, copper, gold, and nickel.[16]

PRODUCTION AND TRADE

The value of mineral production, excluding petroleum products, in 1968 was not reported; however, it probably was between $8 and $9 million, approximately the same as in 1967. Using imported crude oil, the petroleum refinery at Matola produced products valued at an estimated $23 million, compared with an estimated $21 million in 1967.

Detailed trade data were not available for 1967. The total export trade in 1967 was valued at $122.6 million, compared with $112.6 million in 1966. Selected mineral exports were valued at $15.1 million, as follows:[17] Petroleum products, $12.9 million (10.7 million in 1966); metallic minerals, $1.7 million ($1 million in 1966); and coal, $500,000 ($600,000 in 1966). Total imports in 1967 were valued at $200.4 million, compared with $209 million in 1966.

Selected mineral imports were valued at $19.1 million as follows:[18] Crude oil, $11.4 million ($11.2 million in 1966); petroleum products, $4.9 million ($3.4 million in 1966); fertilizer materials, $1.7 million ($1.8 million in 1966); and coal, $1.1 million ($1.2 million in 1966).

COMMODITY REVIEW

Metals.—*Beryllium, Columbium, and Tantalum.*—During the year a Japanese group representing Japan's Metal Association visited Mozambique to learn if it could be a source of beryl, columbite, and tantalite. Columbite and tantalite are mined principally in the Zambezia District.

Gold and Silver.—The gold vein discovered in 1967 near Vila de Manica, at the source of the Chua River, was reported to be 90 centimeters thick and 10 meters wide.[19]

Silver deposits were found near Nampala during a preliminary survey and evaluation of iron ore deposits in the area. Samples were collected, and the Government was considering drilling in the area.[20]

Iron and Steel.—In early 1968 the Japanese Sumitomo Group announced plans to participate with the Portuguese Government in developing the iron ore deposits near Namapa, where reserves were estimated at 360 million tons containing 60 to 64 percent iron. In early 1969, however, the Group canceled its plans because surveys failed to confirm the estimates of the reserves.[21]

Plans to build a steel plant near Beira evidently have been abandoned. The Government canceled the license to build the plant because no definite plans had been submitted.

The Government's authorization of Companhia de Uranio de Moçambique to build a 250,000-ton-per-year steel plant near Tete was still conditional, pending the submission by the company of economic studies and investment. The area near Tete contains iron ore and coal.

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[15] Where necessary, values have been converted at the rate of 1 escudo (Esc.) equals US$0.035.
[16] Mining Journal (London). V. 271, No. 6939, Aug. 16, 1968, p. 118.
[17] Instituto Nacional de Estatistica (Portugal). Anuario Estatistico. V. 2, Provincias Ultramarinas. 1967, pp. 186–188.
[18] Pages 116–171 of work cited in footnote 17.
[19] Journal of Commerce. V. 297, No. 21,722, July 8, 1968, p. 12.
[20] World Mining. V. 4, No. 11, October 1968, p. 54.
[21] Mining Journal (London). V. 272, No. 6964, Feb. 7, 1969, p. 117.

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Table 4.—Mozambique: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Aluminum, bauxite, gross weight	6,278	5,683	5,818	6,276	3,275
Beryl concentrate, gross weight	383	219	80	169	94
Bismuth, mine output, metal content	8	6	2	2	2
Cesium, pollucite, gross weight	4	7	---	---	---
Columbium and tantalum: Ores and concentrates, gross weight:					
Columbite-tantalite	r 46	r 52	56	89	62
Microlite	154	85	79	70	90
Copper, ore and concentrate, gross weight	122	340	696	214	NA
Gold, metal, troy ounces	40	32	22	22	6
Thorium (monazite), kilograms	---	---	11	300	350
Tin, ore and concentrate, gross weight, long tons	---	101	584	446	---
NONMETALS					
Abrasives, natural [2], garnet, kilograms	---	2,724	1,586	1,021	9,012
Asbestos	---	80	486	507	120
Cement, hydraulic, thousand tons	182	220	225	• 248	• 288
Clays:					
Bentonite (including montmorillonite)	825	2,723	3,866	4,631	3,818
Kaolin (including china clay)	10	105	350	577	350
Diatomite	---	---	30	5	209
Feldspar	---	50	---	120	100
Gem stones, tourmaline, kilograms	2,455	317	4,540	4,128	866
Lime	6,629	6,472	NA	NA	NA
Lithium minerals (mainly lepidolite)	---	75	NA	250	748
Mica (mainly scrap)	---	10	NA	100	336
Perlite	---	24	181	---	---
Quartz, kilograms	[3] 452	[4] 405,400	---	r 80,000	[5] 802,628
Salt, marine [6], thousand tons	---	30	26	38	18
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous, thousand tons	245	238	295	282	314
Petroleum refinery products:					
Gasoline, thousand 42-gallon barrels	864	887	999	r 1,126	[7] 1,182
Distillate fuel oil, do	998	1,106	1,436	r 1,675	[7] 1,844
Residual fuel oil, do	1,640	1,609	1,989	r 2,108	[7] 2,378
Liquefied petroleum gas, do	26	30	• 31	r 56	[7] 73
Total, do	3,528	3,632	• 4,455	r 4,965	[7] 5,477

• Estimate. r Revised. NA Not available.

[1] The following commodities are also produced, but the amounts generally are small or quantitative data are lacking: Construction materials (clay, sand, gravel, dimension stone), limestone, samarskite, amazonite, and euxenite (5,700 kilograms produced in 1968).

[2] In 1968, 13,285 kilograms of industrial topaz was produced.

[3] Quartz crystal.

[4] Includes 400 kilograms of quartz crystal.

[5] Includes 2,628 kilograms of quartz crystal.

[6] Includes 20 to 30 tons of rock salt annually except in 1968.

[7] Estimate based on data for 11 months.

Nonmetals.—*Cement.*—During the year Companhia de Cimentos de Moçambique announced plans to increase its production by 60,000 tons per year, mainly to supply cement for the dam to be built at the Cabora-Bassa Gorge. Cement for the dam would come either from the company's plant at Dondo or from a new plant that would be built at Tete, about 100 kilometers below the dam site. The company also has cement plants at Nacala and Matola, near Lourenço Marques.

Fertilizer Materials.—Early in the year the fertilizer plant at Matola began full operations. The sulfuric acid facility has been operating since November 1967. Ammonium sulfate and single superphosphate will be produced.[22]

Gem Stones.—A deposit of tourmaline reportedly has been found at Nova Freixo, 80 kilometers from the Malawi border.[23] According to press reports, French, Japanese, and North American financiers have shown an interest in purchasing semiprecious stones from Mozambique.[24]

Mineral Fuels.—*Coal.*—Coal is mined on a 200-square-kilometer concession at

[22] Journal of World Phosphorus and Potassium. No. 33, January/February 1968, p. 9.

[23] Mining Journal (London). V. 271, No. 6951, Nov. 8, 1968, p. 363.

[24] Overseas Review (London). Barclays Bank D.C.O. September 1968, p. 26.

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Table 5.—Mozambique: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, bauxite and concentrate	5,890	• 6,200
Beryllium, beryl ore and concentrate	82	• 160
Bismuth, ore and concentrate kilograms	1,000	• 1,000
Chromium, ore and concentrate	37,043	NA
Columbium and tantalum:		
Columbite-tantalite kilograms	72,500	• 75,000
Microlite do	70,012	• 60,000
Copper:		
Ore and concentrate	680	• 200
Matte	456	NA
Iron and steel:		
Ore and concentrate	6,532	NA
Metal:		
Scrap	5,389	NA
Pig iron, ferroalloys and similar materials	28,326	NA
Lead, metal, including alloys, unwrought, and semimanufactures	760	NA
Tin, ore and concentrate long tons	54	NA
Other, nonferrous metal scrap and waste	27,528	5,938
NONMETALS		
Abrasives, natural, garnet kilograms	3,789	NA
Asbestos	206	NA
Cement	11,468	NA
Clays and clay products, crude clays, montmorillonite	3,469	• 4,000
Diatomite and other infusorial earths	30	• 5
Perlite	181	(•)
Precious and semiprecious stones:		
Amazonite kilograms	22,370	NA
Tourmaline do	797	NA
Salt, marine	8,924	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, bituminous and coke	85,912	78,411
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	770	915
Distillate fuel oil do	772	1,082
Residual fuel oil do	1,882	2,128

• Estimate. NA Not available.

Table 6.—Mozambique: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys	466	NA
Copper, metal, matte and wrought	627	[1] 393
Iron and steel: Metal:		
Scrap	([2])	NA
Pig iron, ingots, primary forms	11,885	NA
Semimanufactures	59,046	38,540
Tin: Metal, including alloys all forms long tons	47	NA
NONMETALS		
Asbestos	439	NA
Clay and clay products, including refractory bricks:		
Brick and tile	2,091	NA
Fertilizer materials, manufactured:		
Nitrogenous	15,354	• 23,500
Other	9,441	
Stone, sand, and gravel:		
Dimension stone	952	NA
Sand and gravel	1,779	NA
Other nonmetals	914	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquet	[r] 228,434	209,296
Petroleum:		
Crude thousand 42-gallon barrels	4,884	5,008
Refinery products:		
Gasoline do	240	251
Kerosine do	167	156
Residual fuel oil thousand 42-gallon barrels	388	420
Lubricants do	69	70

• Estimate. NA Not available.
[1] Semimanufactures.
[2] Included with semimanufactures.

Moatize, near Tete, where reserves of minable coal total about 300 million tons.[25] The coal is used mainly by the railroads.

Petroleum.—Exploration continued during the year, but no oil discoveries were reported. The natural gas deposits found in the past have not been developed commercially. Concessions covered most of the potentially petroliferous areas of the country, both onshore and offshore.

During the year Mozambique Gulf Oil Company and Pan American Oil Company were granted another joint concession, covering 47,700 square kilometers, which gives the combine about 167,100 square kilometers of concession area. Texaco, Inc., a newcomer, received a 16,800-square-kilometer concession in northern Mozambique. West Germany's Gelsenkirchener Bergwerks A.G. (Gelsenberg) acquired the 10-percent share that France's Entreprises de Recherches et d'Activités Petrolieres (ERAP) held in an exploration venture with Société Nationale des Pétroles d'Acquitaine (SNPA) and Anglo-American Corporation of South Africa, Ltd. (AAC). Gelsenberg also acquired an additional 10

[25] The Standard Bank of South Africa, Ltd. (Johannesburg). Supplement to The Standard Bank Group. Mozambique: An Economic Survey. November 1968, p. 8.

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percent in the concessions from AAC, making the ownership of the group as follows: SNPA, 40 percent; AAC, 40 percent; Gelsenberg, 20 percent.

The capacity of the refinery at Matola, near Lourenço Marques, is to be increased from 16,240 barrels per day (b/d) to about 40,600 b/d by late 1970. Sociedade Nacional de Refinacao de Petroleos (SONAREP), the operator, estimates that the expansion will cost about $26 million. The increased capacity will enable Mozambique to increase exports of products to neighboring countries.

Two crude oil storage tanks, totaling 600,000 barrels in capacity, were being constructed near the refinery. When completed, they will raise the total crude oil storage capacity to about 1 million barrels. The storage capacity for refined products was also being increased, but detailed data were not available.

PORTUGUESE GUINEA

No mineral developments were reported in 1968, and production probably consisted only of small amounts of construction materials for local use. Two possible important mineral resources are bauxite and petroleum. Deposits of bauxite totaling 110,000 tons reportedly exist near the border with Guinea, but they have not been exploited because transportation to the area reportedly is inadequate.

Esso Exploration Guiné, Inc., the only petroleum exploration company, drilled during the year, but no discoveries were reported. Several wells, all dry, were drilled in past years in the coastal areas in the northwest.

In 1967 the country's imports of mineral commodities were valued at $1.27 million, compared with a value for total imports of $16.4 million.[26] Data for 1966 are incomplete. The 1967 mineral imports were cement, 7,810 tons; gasoline, 37,414 barrels; kerosine, 16,655 barrels; and distillate fuel oil, 55,144 barrels.[27]

[26] Where necessary, values have been converted at the rate of 1 escudo (Esc.) equals $0.035.
[27] Page 147 of work cited in footnote 17.

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The Mineral Industry of Argentina

By Garn A. Rynearson[1]

The Argentina mineral industry made notable progress during 1968 in harmony with the success attained by the Government's stabilization program. In a climate characterized by unusual political and economic stability, the industry registered substantial increases in production of crude petroleum and refinery products, of most iron and steel products, and of cement and other nonmetallic mineral commodities consumed by the construction industry. With the exception of a strike over working hours at oil refineries, which resulted in the dismissal of a large number of employees at one refinery, the mineral industry was relatively unaffected by labor disputes. Official figures indicated the nationwide loss of man-days of work due to strikes in all sectors was only 23,500 days in 1968, compared with 244,800 days in 1967 and 1,912,800 days in 1966.

Important steps were taken during the year to implement future growth of the mineral industry. As a result of new Government policies, large investments were committed to projects involving exploration, production, and refining of petroleum and to expansion projects in the iron and steel industry. Several expansion projects also were underway to increase the industry's capacity to mine and process lead and zinc ore, sulfur, and other commodities. In addition plans were well advanced to expand several cement plants, to construct new petrochemical facilities, and to open numerous reserved areas for large-scale mineral and petroleum exploration.

A $5.5 million preinvestment mineral survey of parts of San Juan, Mendoza, and Neuquén Provinces was completed by the Argentine Government and the United Nations Special Fund in June, and a final United Nations report on the results of the 5-year investigation was prepared. This study resulted in the discovery and partial evaluation of a number of large, low-grade, porphyry-type copper deposits with associated molybdenum, as well as indications of other types of copper, lead, and zinc mineralization of possible commercial significance. The Government planned to issue an international call for bids on exploration concessions, including the option

[1] Physical scientist, Division of International Activities.

Table 1.—Argentina: Selected economic indicators

Indicator	1966	1967	1968
Population at midyear, in thousands [1]	22,691	23,031	23,423
Gross national product (GNP): [1]			
Total GNP, in million 1967 dollars [2]	14,685	14,945	p 15,650
Percent change from previous year	−1.0	+1.8	p +4.7
GNP per capita, in 1967 dollars	647	649	668
Index of industrial production (1960 = 100) [3]	129.1	129.1	p 139.3
Cost of construction index (1960 = 100) [3]	437.5	p 563.4	p 606.2
Cost of living index (Buenos Aires), percent above that of previous year: [3]			
Based on average monthly index	31.9	29.2	16.2
Based on December index	29.9	27.4	9.6

p Preliminary.
[1] U.S. Agency for International Development. Economic Data Book for Latin America: Argentina. April 1969.
[2] Converted at 350 Argentine pesos per U.S. dollar.
[3] Ministerio de Economía y Trabajo, República Argentina. Informe Economico, 4th quarter, 1968 and 1st quarter, 1969.

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to acquire exploitation rights, in selected areas during 1969. In the meantime, further exploratory work was undertaken jointly by provincial agencies and the Dirección General de Fabricaciones Militares, the national agency in charge of mineral development.

A similar preinvestment mineral survey was being conducted by Fabricaciones Militares and the Instituto Nacional de Geología y Minería in parts of Salta, Jujuy, La Rioja, Catamarca, and Tucumán Provinces. Although this $8 million project was only in the early stages of geological photointerpretation and geochemical prospecting, it was reported that promising copper deposits already had been found in La Rioja and Catamarca Provinces.

Several calls for international bids to develop the Sierra Grande iron ore deposits in Río Negro Province failed to bring forth satisfactory proposals, but the Government continued to place a high priority on the project. It was reported that Fabricaciones Militares began a pilot plant feasibility study on the possibilities of pelletizing Sierra Grande ore using domestic coal from Río Turbio.

PRODUCTION

Output of most of the more important minerals, metals, and fuels produced for domestic consumption increased significantly during 1968. Although a 2-month shutdown for repairs to the nation's only large blast furnace resulted in a net decrease of about 5 percent in total pig iron output, the steel industry trebled pig iron imports and managed to increase its crude steel production about 17.5 percent to a record level and its output of hot-rolled semimanufactures about 14 percent to equal the record level attained in 1965.

The nation's cement producers utilized most of their installed capacity to produce a record amount of portland cement for the booming construction industry. Most producers of raw materials for cement and concrete and other mineral commodities consumed in construction also met the challenge of higher demand by raising output of their products.

In the mineral fuels sector, attainment of record levels in the production of crude oil (up 9.4 percent) and in the amount of natural gas marketed (up 11.5 percent) represented important contributions to the national economy. Production of washed coal increased 14.6 percent to 471,400 tons; however, sales during the year amounted to only 355,200 tons, compared with 353,800 tons in 1967, as inadequate transport facilties continued to be a major problem in moving the coal from the remotely located fields to potential consumers.

Table 2.—Argentina: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 p
METALS					
Antimony, mine output, metal content	-------	-------	1	7	-------
Beryl concentrate, gross weight	189	225	255	269	593
Bismuth, mine output, metal content--kilograms	4	-------	-------	78	3,125
Columbite-tantalite, gross weight--do	-------	267	5,726	3,000	-------
Copper, mine output, metal content	345	518	337	501	422
Gold, mine output, metal content--troy ounces	303	84	160	35	14
Iron and steel: [2]					
Iron ore and concentrate--thousand tons	95	116	156	226	277
Pig iron--do	588	663	522	604	574
Ferroalloys--do	15	18	r 22	18	NA
Steel ingots--do	1,265	1,368	1,267	1,326	1,559
Semimanufactures (rolled products)--do	r 1,328	1,537	1,274	1,348	1,537
Lead:					
Mine output, metal content	25,924	32,236	29,483	32,253	26,616
Metal [3]	23,000	32,000	22,000	22,000	25,000
Manganese ore and concentrate, gross weight:					
30 to 40 percent manganese	19,400	20,363	11,768	26,356	27,060
Less then 30 percent manganese	17,868	8,751	16,002	10,179	3,941
Mercury--76-pound flasks	-------	-------	29	17	-------
Silver, mine output, metal content--thousand troy ounces	1,943	2,286	2,207	1,697	2,422

See footnotes at end of table.

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Table 2.—Argentina: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS—Continued					
Tin, mine output, metal content—long tons	343	497	458	802	701
Tungsten, mine output, metal content	29	69	69	107	184
Uranium, mine output, U_3O_8 content—kilograms	33,536	44,937	249	23,238	42,688
Vanadium, mine output, metal content	3	-------	-------	-------	-------
Zinc:					
Mine output, metal content	22,913	29,679	26,446	27,204	26,286
Metal [3]	22,200	23,600	[r] 22,300	23,000	21,000
NONMETALS					
Abrasives, natural, n.e.s., garnet	90	60	85	95	65
Asbestos	492	220	57	500	346
Barite	14,505	19,816	17,987	22,052	16,178
Boron materials, crude	16,115	45,700	35,345	17,968	21,026
Calcite, nonoptical	6,763	[r] 5,500	5,098	6,866	5,960
Cement, hydraulic [4]—thousand tons	[r] 2,913	3,305	[r] 3,484	3,551	4,211
Chalk	33,685	42,031	55,467	45,084	56,426
Clays:					
Bentonite	36,928	47,666	42,632	42,459	46,652
Decolorizing clay	3,602	5,543	4,172	5,976	10,427
Kaolin	42,727	72,948	73,430	64,096	72,148
Refractory clay	94,020	118,062	113,062	115,375	114,549
Other—thousand tons	291	455	530	884	1,320
Diatomite	7,772	6,145	10,943	8,146	6,547
Feldspar	9,273	21,640	21,409	20,350	20,503
Fertilizer materials:					
Crude natural phosphates (guano)	180	120	65	236	294
Manufactured, nitrogenous:					
Ammonia, anhydrous [5]	4,981	5,692	5,967	5,480	NA
Ammonium sulfate [5]	13,291	11,653	13,141	12,678	NA
Fluorspar, all grades	11,524	11,687	16,088	19,255	19,895
Graphite	222	183	157	214	110
Gypsum, crude	154,542	246,312	288,202	264,653	371,031
Lithium minerals	725	622	270	247	127
Mica:					
Sheet	[r] 143	105	132	136	94
Waste and scrap	532	118	958	1,003	597
Pigments, natural mineral, ocher	25	48	65	40	85
Quartz and quartzite:					
Common quartz	21,433	35,625	49,780	47,585	45,500
Quartzite	766,720	730,571	761,802	804,324	915,261
Glass sand	98,972	137,931	130,429	116,907	192,959
Salt, all types	393,112	766,712	893,720	857,611	740,200
Sodium compounds, n.e.s., caustic soda [5]	40,630	51,145	50,842	47,564	NA
Stone, sand, and gravel, n.e.s.:					
Dimension stone:					
Marble and other calcareous	16,156	15,670	24,150	23,773	20,378
Other, excluding quartzite:					
Flagstone	16,490	24,643	29,004	32,713	25,874
Granite	7,025	5,547	7,679	9,909	12,441
Sandstone	26,156	22,061	8,227	7,482	12,267
Slate	81	8	20	6	-------
Crushed and broken:					
Dolomite	102,402	104,800	139,566	198,018	138,632
Limestone—thousand tons	6,598	7,619	8,257	9,491	10,896
Other calcareous, marble	23,907	52,976	49,768	57,491	58,304
Rhodochrosite, including ornamental	-------	122	309	206	159
Other, excluding quartzite:					
Granite—thousand tons	2,189	2,566	2,748	3,101	4,361
Miscellaneous	204,379	203,833	182,387	275,923	715,472
Gravel—thousand tons	1,820	1,499	1,896	3,205	4,963
Sand, excluding glass sand—do	5,203	5,726	6,884	7,409	8,178
Strontium mineral, celestite	30	598	370	30	70
Sulfur, elemental, refined	22,307	23,766	30,422	32,796	33,638
Sulfates, natural:					
Aluminum (alum)	12,716	7,707	3,834	2,614	2,137
Iron (melanterite)	-------	900	362	185	8
Magnesium (epsomite)	2,637	3,020	1,136	1,471	1,996
Sodium (mirabilite)	9,242	21,927	21,903	27,617	20,084
Talc and related materials:					
Pyrophyllite	7,245	9,267	6,640	7,867	6,252
Steatite	6,409	1,350	2,767	1,327	1,940
Talc	11,144	20,851	20,442	16,908	19,146
Vermiculite	3,693	1,685	4,162	2,904	2,311
Zeolites	80	68	25	48	52

See footnotes at end of table.

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Table 2.—Argentina: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	4,401	3,817	[r] 5,800	3,857	1,326
Carbon black	11,400	14,500	20,000	24,000	30,000
Coal, all grades—thousand tons	332	374	357	411	[e] 471
Coke, all types [7]—do	460	458	396	452	365
Gas, natural:					
Gross production [8]—million cubic feet	232,572	220,236	210,576	228,419	249,486
Marketed [8]—do	[r] 130,996	[r] 153,893	164,280	169,257	188,806
Natural gas liquids:					
Natural gasoline—thousand 42-gallon barrels	896	1,160	979	600	537
Liquefied petroleum gases—do	1,323	1,247	1,188	1,098	1,299
Peat, agricultural	3,877	3,652	5,194	2,298	NA
Petroleum:					
Crude oil—thousand 42-gallon barrels	100,276	98,276	104,760	114,673	125,488
Refinery products: [9]					
Aviation gasoline—do	384	190	456	550	351
Motor gasoline and naphthas—do	[r] 23,777	[r] 27,487	[r] 29,393	30,643	30,198
Kerosine—do	8,502	7,727	7,138	6,714	6,281
Jet fuel—do	779	943	1,103	1,460	1,708
Distillate fuel oil—do	17,958	22,353	26,587	27,284	28,913
Residual fuel oil—do	46,868	52,906	54,233	53,030	54,188
Liquefied petroleum gas—do	2,436	2,517	2,600	2,845	3,456
Lubricants—do	979	1,058	983	875	961
Asphalt and bitumen, refinery—do	2,910	2,265	1,823	2,071	3,702
White spirit—do	304	302	263	282	228
Solvents—do	438	481	420	398	391
Petroleum coke—thousand tons	351	356	424	435	436
Refinery gas [8]—million cubic feet	9,712	9,768	10,774	11,115	9,615

[p] Preliminary. [r] Revised. NA Not available.

[1] In addition to commodities listed, Argentina produces unreported amounts of cadmium metal, lime, perlite, pumice, and Thomas slag and urea for fertilizer use. Sporadic production of small quantities of chromite, corundum, molybdenite, and unspecified titanium minerals was reported during the period covered but these commodities are not listed.

[2] Metal and alloy data were compiled from statistics published by Instituto Latinoamericano del Fierro y el Acero, and exclude small quantities of foundry-produced crude steel and castings totaling approximately 15,000 to 25,000 tons per year.

[3] Estimates based on statistics compiled by American Bureau of Metal Statistics.

[4] Data include white and special cement as well as common portland cement.

[5] Output reported by Fundación Investigaciones Económicas Latinoamericanas.

[6] Excludes a relatively small quantity of usable but noncommercial washed coal.

[7] Coke and coke breeze produced by Sociedad Mixta Siderúrgia Argentina (SOMISA), the principal producer.

[8] Converted from cubic meters at rate of 1 cubic meter equals 35.3145 cubic feet.

[9] Includes some products derived in part from natural gas and natural gasoline.

Source: Instituto Nacional de Geología y Minería and Dirección Nacional de Energía y Combustibles for most commodities. Principal exceptions are indicated in footnotes.

TRADE

Mineral commodities constitute a relatively small part of Argentina's exports; however, imports of such commodities, principally iron and steel products and mineral fuels, represent about 30 percent of the value of all imports. A tabulation comparing trade in mineral commodities and total trade follows:

	Value (million dollars)	
	1966	1976
Exports:		
Mineral commodities:		
Metals	11.9	16.5
Nonmetals	2.0	2.2
Mineral fuels	15.1	8.9
Total	29.0	27.6
All commodities, total	1,593.2	1,464.5
Imports:		
Mineral commodities:		
Metals	208.1	198.2
Nonmetals	27.5	30.5
Mineral fuels	111.0	101.4
Total	346.6	330.1
All commodities, total	1,124.3	1,095.3
Net trade balance:		
Mineral commodities	−317.6	−302.5
All commodities, total	+468.9	+369.0

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Preliminary data for 1968 indicated Argentina's trade surplus fell sharply to $198.7 million as the total value of exports decreased to $1,367.9 million and imports rose to a total of $1,169.2 million. Although data for many of the mineral commodities traded were not available, an increase in the value of exports and a net decrease in imports were indicated.

Exports of iron and steel products, especially bars and rods, profiles, and pipes, increased sharply from a total value of about $11.7 million in 1967 to $24.7 million in 1968. Also notable was a $2.3 million increase in the value of fuel oil exports to a total of about $9 million.

Although imports of pig iron increased from 98,000 tons in 1967 to 280,400 tons in 1968, the net value of all iron and steel products imported decreased from approximately $136 million in 1967 to $124 million in 1968. Decreases of about $3.6 million in iron ore imports and $4.9 million in coal and coke imports were attributable to the difficulties encountered in blast furnace operations. Increased production of domestic crude oil permitted a reduction of about $9 million in crude oil imports, but this savings was largely offset by an increase of about $6.2 million in the value of gas oil imports. Available data also indicated increases of about $4.7 million in the value of unwrought aluminum imports and about $3.7 million in copper imports.

Table 3.—Argentina: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	11	10
Beryl ore and concentrate	248	266
Copper:		
Ore and concentrate [1]	267	194
Metals, including alloys, all forms	14	12
Iron and steel:		
Ingots, and other primary forms	12,133	3,888
Semimanufactures:		
Bars and rods:		
Wire rod	26,845	35,574
Other	7,883	13,643
Angles, shapes, sections	3,961	3,515
Universals, plates, sheets	2,561	1,857
Wire	2,823	5,276
Tubes, pipes, fittings	20,521	38,289
Other	29	161

Table 3.—Argentina: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS—Continued		
Lead:		
Ore and concentrate	218	660
Metal, including alloys, all forms	1	1
Silver, metal thousand troy ounces	219	774
Tantalite kilograms	4,114	2,999
Tin:		
Ore and concentrate long tons	3,222	4,118
Metal, including alloys long tons	1	[2]
Tungsten, ore and concentrate	50	107
Zinc, metal, including alloys, all forms	102	935
Other:		
Ore and concentrate, n.e.s.	2	------
Ash and residue containing nonferrous metal	347	256
Metals, including alloys, all forms, n.e.s.	[2]	2
NONMETALS		
Barite	233	55
Boron materials, crude natural borates	160	158
Cement	7,518	16,870
Clays:		
Bentonite	6,442	5,350
Kaolin	5	42
Other	8	53
Fluorspar	881	345
Gypsum	18,437	13,312
Lime	67	30
Mica	332	316
Onyx	213	60
Rhodochrosite, ornamental kilograms	1,550	19,108
Salt	59,883	49,018
Stone, sand and gravel:		
Dimension stone	4,097	6,300
Dolomite	1,430	2,401
Other	124	141
Talc, steatite, soapstone, pyrophyllite	65	125
Other nonmetals	242	956
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	5,967	6,601
Carbon black	3,213	4,268
Coal, all grades	1,400	50
Gas, hydrocarbon, liquefied or not	517	1,712
Petroleum:		
Crude	3,088	9,239
Refinery products:		
Gasoline thousand 42-gallon barrels	4	108
Kerosine do.	2	[2]
Distillate fuel oil thousand 42-gallon barrels	1,317	[2]
Residual fuel oil do.	6,402	4,901
Lubricants do.	232	517
Other	2,081	4,421
Mineral tar and crude chemicals from coal, petroleum, and natural gas	308	730

[1] Including concentrates containing significant amounts of silver.
[2] Less than ½ unit.

Source: Dirección Nacional de Estadística y Censos, Comercio Exterior Argentino, 1966. Instituto Nacional de Estadística y Censos, Comercio Exterior Argentino, 1967.

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Table 4.—Argentina: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	43,561	34,077	Australia 20,447; Guyana 11,700.
Oxide (alumina) and hydroxide	7,203	6,535	Mainly from West Germany.
Metal, including alloys, all forms	36,991	31,211	United States 9,466; Canada 8,103; France 4,648; Italy 3,872.
Antimony, ore and concentrate	434	492	Bolivia 232; Peru 219.
Arsenic, trioxide	489	402	Sweden 134; West Germany 133; Belgium 105.
Bismuth, metal	16	18	Peru 9; Mexico 8.
Cobalt:			
Oxide and hydroxide	10	10	Belgium 7; West Germany 2.
Metal	45	60	Mainly from Belgium.
Copper, metal, including alloys, all forms	18,499	17,152	Chile 13,461; West Germany 1,824.
Iron and steel:			
Ore and concentrate—thousand tons	707	880	Mainly from Brazil.
Metal:			
Scrap—do	25	30	United States 20; United Kingdom 10.
Pig iron, including spiegeleisen—do	243	99	Finland 47; U.S.S.R. 26.
Ferroalloys	2,582	2,346	Republic of South Africa 656; France 460; Brazil 409.
Ingots and other primary forms—thousand tons	330	365	Belgium 124; Venezuela 70; West Germany 62; United States 54.
Semimanufactures:			
Bars and rods—do	29	32	Chile 9; Austria 5; Italy 4; France 3; Brazil 3.
Angles, shapes, sections—do	12	18	Japan 4; West Germany 4; United Kingdom 3; United States 2.
Universals, plates, sheets:			
Tinned plates and sheets—thousand tons	104	110	United Kingdom 87; Japan 24; United States 20.
Other coated plates and sheets—thousand tons	2	2	Mainly from United States.
Other (uncoated)—thousand tons	205	280	Brazil 108; United Kingdom 89; West Germany 33; Italy 28.
Hoop and strip—do	7	13	United Kingdom 4; United States 4.
Rails and accessories—do	(1)	1	Mainly from West Germany.
Wire—do	2	2	Mainly from Italy.
Tubes, pipes, fittings—do	10	13	Italy 3; Venezuela 2; Unied States 2; Japan 2.
Other, n.e.s.—do	1	1	Mainly from United States.
Lead, metal, including alloys, all forms	22	552	Mexico 435; United Kingdom 115.
Manganese:			
Ore and concentrate	20,246	11,500	Mainly from Brazil.
Oxides	3,732	2,922	United States 2,439; Japan 406.
Metal	17	18	Japan 10; United Kingdom 5.
Mercury—76-pound flasks	710	248	Mainly from Mexico.
Nickel, metal, including alloys, all forms	511	448	Canada 158; United States 118, Norway 68.
Precious metal and alloys, unwrought and semimanufactures—troy ounces	49,126	87,771	United States 54,949; West Germany 20,287.
Rare earth metals and compounds	15	16	Brazil 4; United Kingdom 3.
Selenium, elemental	7	7	Mainly from Canada.
Tin:			
Oxides—long tons	1	4	Mainly from West Germany.
Metal, including alloys, all forms—do	1,471	846	Mainly from Malaysia.
Titanium:			
Ore and concentrate	909	807	Mainly from Australia.
Oxides	3,031	2,101	West Germany 848; Italy 378; Belgium 344.
Zinc, metal, including alloys, all forms	3,456	2,498	Mexico 1,104; Canada 563; Belgium 495.
Zirconium, ore and concentrate	535	842	Australia 485; Mexico 150.
Other:			
Ore and concentrate	r (1)	52	Mainly from Republic of South Africa.
Metals, including alloys, all forms	268	274	United States 136; Norway 107.
NONMETALS			
Abrasives, natural, n.e.s.	802	289	Mainly from United States.
Asbestos	13,826	14,436	Canada 9,695; Republic of South Africa 4,515.
Barite	63	20	Mainly from United States.
Bromine	84	156	Mainly from Israel.
Cement	351	395	Mainly from United States.
Chalk	98	317	Belgium 187; France 129.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Fire clay	373	337	West Germany 132; France 92.
Kaolin	10,663	11,594	United States 9,782; United Kingdom 1,658.
Other	25	26	Mainly from United States.

See footnotes at end of table.

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Table 4.—Argentina: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Clays and clay products—Continued			
Products:			
Refractory (including nonclay brick and cement).	31,482	24,532	United States 7,073; United Kingdom 3,159; West Germany 2,658.
Nonrefractory	2	62	Mainly from Italy.
Diamond: [3]			
Gem—value	------	$6,266	Belgium $5,537; Israel $729.
Industrial—do	$95,770	$55,627	Brazil $22,266; Belgium $17,198; United States $9,985.
Powder—do	$30,964	$49,983	Netherlands $17,956; United States $14,833; Sweden $9,102; United Kingdom $6,119.
Diatomite, and other infusorial earths	2,777	2,724	United States 1,572; Mexico 1,150.
Fertilizer materials:			
Nitrogenous:			
Natural	9,073	9,690	All from Chile.
Manufactured	15,592	66,755	Netherlands 21,054; Italy 15,696; West Germany 9,651.
Phosphatic	5,562	7,727	United States 3,852; Netherlands 2,654.
Potassic	3,568	7,592	West Germany 4,797; United States 2,195.
Mixed and nonspecified fertilizers	35,900	51,761	United States 19,210; Italy 13,360; Netherlands 10,811.
Graphite, natural	346	231	West Germany 86; Norway 40; mainland China 40.
Iodine	24	17	Mainly from Chile.
Kyanite, andalusite, sillimanite	381	558	Mainly from India.
Lithium and lithium compounds	74	22	United States 10; Netherlands 6; West Germany 4.
Magnesite	2,188	2,718	Brazil 1,185; United States 886.
Mica	9	12	United States 7; United Kingdom 5.
Pigments, mineral	1	73	Mainly from Spain.
Sodium and potassium compounds, excluding salt:			
Caustic soda	5,325	11,028	United States 6,372.
Caustic potash	979	1,347	West Germany 729; Netherlands 265.
Sodium carbonate	127,656	116,625	United States 43,029; Rumania 33,128; United Kingdom 13,931.
Stone, sand and gravel:			
Dimension stone	r 1,697	2,935	Italy 2,414; Brazil 354.
Dolomite	15,203	17,314	Mainly from Uruguay.
Gravel and crushed rock—thousand tons	444	344	Paraguay 187; Uruguay 157.
Sand—do	698	604	Mainly from Uruguay.
Sulfur, elemental, all forms	35,541	21,031	Mainly from United States.
Talc, steatite, soapstone, pyrophyllite	230	507	Mainly China 275; Italy 120.
Other nonmetals, n.e.s.	r 1,074	27,031	Mainly from Peru.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	228	266	Mainly from United States.
Carbon black	2,301	1,075	United States 618; Canada 269; West Germany 184.
Coal—thousand tons	698	807	United States 611; Poland 195.
Coke—do	52	39	West Germany 25; Italy 8; Belgium 4.
Gas, hydrocarbon, liquefied or not—do	208	355	Venezuela 163; Saudi Arabia 75; Belgium 42.
Petroleum:			
Crude—do	3,705	2,288	Venezuela 779; Iran 356.
Refinery products:			
Gasoline—thousand 42-gallon barrels	211	140	Mainly from Netherlands Antilles.
Kerosine—do	1	61	Mainly from Trinidad and Tobago.
Distillate fuel oil—do	3,292	1,170	U.S.S.R. 737; Italy 275; Venezuela 128.
Residual fuel oil—do	r 107	(1)	All from West Germany.
Lubricants—thousand tons	96	74	United States 40; Venezuela 33.
Other—do	1	4	United States 2; Paraguay 1.
Mineral tar and crude chemicals from coal, petroleum, and natural gas.	47,995	51,958	Mainly from Venezuela.

r Revised.
[1] Less than ½ unit.
[3] Data on quantity incomplete or not reported.

Source: Dirección Nacional de Estadística y Censos, Comercio Exterior Argentino, 1966. Instituto Nacional de Estadística y Censos, Comercio Exterior Argentino, 1967.

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COMMODITY REVIEW

METALS

Iron and Steel.—In December the Government approved the 5-year (1969–74) National Steel Plan recommended by the Dirección General de Fabricaciones Militares which is intended to ensure Argentina self-sufficiency in common steel by 1974. Under the Plan, the Government will provide certain guarantees and privileges to implement expansion of capacity at the nation's only large integrated mill, that of Sociedad Mixta Siderúrgia Argentina (SOMISA), to 2,500,000 tons by yearend 1972 and the installation of facilities to produce 1,360,000 tons of crude steel by 1973 at the new integrated mill being constructed by Propulsora Siderúrgia, S.A. The small integrated plant operated by Fabricaciones Militares reportedly will expand its capacity from 192,000 to 300,000 tons by 1972 as part of the Plan. Acindar, Industria Argentina de Aceros, S.A., one of the largest private semiintegrated steel companies, apparently will be excluded from participation in the present National Steel Plan, although four alternate expansion plans submitted by the company in December still were being reviewed at yearend. The principal role of Acindar and other private semiintegrated steel companies in the basic steel policy presumably will be to continue production of special and alloy steels from domestic scrap or from imported scrap and pig iron if necessary.

SOMISA, which accounts for most of the pig iron and more than half the crude steel produced in the country, continued to be plagued by technical problems with its blast furnace. In mid-March another breach in the hearth shut the furnace down 63 days for repairs. Although the furnace operated normally during the remainder of the year, total output of pig iron dipped almost to the low level of 1966 when the furnace was totally relined. In the hope of avoiding further problems of this nature, a decision was made to reline the furnace again early in 1969, utilizing a more advanced design and superior refractory materials.

With the exception of pig iron, coke, and coke byproducts, output of nearly all other SOMISA products surpassed 1967 levels. According to data supplied by the company, production of crude iron and steel and principal mill products for calendar years 1967 and 1968 was as follows, in metric tons:

Product	1967	1968
Pig iron	523,364	464,863
Crude steel	745,975	845,520
Billets	395,206	503,679
Slabs	262,300	266,669
Profiles	9,931	9,963
Sheets, hot rolled	86,788	114,652
Coils, hot rolled	127,187	181,176
Rails	33,780	12,086
Sheets and coils, cold rolled	224,043	277,157
Tinplate, electrolytic	8,924	4,580

Preliminary data for 1968 indicated total output of hot-rolled products by the steel industry as a whole included about 1,160,300 tons of semifinished steel (billets and slabs); 126,300 tons of angles, shapes, and sections; 432,300 tons of reinforcing bars; 231,600 tons of wire rod; 202,400 tons of other bars; 378,000 tons of sheets and coils; 117,619 tons of seamless pipe; and 48,700 tons of other products, including rails. Production of all products listed except hot-rolled sheets and "other" products was significantly higher than 1967 output. In 1968, only 313,000 tons of hot-rolled sheet was produced compared with 494,500 tons in 1967.

Lead and Zinc.—Cía. Minera Aguilar, S.A., the Argentine affiliate of St. Joseph Lead Co., essentially completed an expansion program at its mine and mill in Jujuy Province which is expected to increase the capacity of the facilities by 75 percent. The main haulage system at the mine was electrified, an automatic dumping station and a new primary crusher were installed, and capacity of the aerial tramway was increased. Expansion and modernization of the mill involved addition of secondary crushers, new ball mills, and enlargement of flotation facilities.

Despite interruptions for installation of new equipment and additions to the mill, Aguilar's operating level was about the same as in 1967. The company milled 334,265 metric tons of ore averaging 7.98 percent lead, 8.69 percent zinc, and nearly 6.2 ounces of silver per ton. Output of lead concentrate totaled 31,139 metric tons averaging 76.67 percent lead and approxi-

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mately 48 ounces of silver per ton. Output of zinc concentrate amounted to 51,069 metric tons averaging 49.96 percent zinc and nearly 6.3 ounces of silver per ton.

Approximately half the lead concentrate produced by Aguilar was sold to National Lead Co., S.A., which operates the country's largest lead smelter, and the remainder was sold to other buyers for processing at a number of medium and small size smelting facilities in Argentina. Most of the zinc concentrate was shipped to two smelters partly owned by Aguilar. The smelter operated by Cía. Sulfacid, S.A., near Rosario received 27,835 tons and that operated by Cía. Metalúrgia Austral at Comodoro Rivadavia received 18,885 tons. In addition, nearly 6,000 tons of zinc concentrate was shipped to the Río Tercero plant of Fabricaciones Militares.

Sulfacid proceeded with plans to expand its zinc refinery and sulfuric acid plant. A new roaster and an increase in electrolytic tank capacity will eventually double productive capacity of these plants.

NONMETALS

Cement.—The portland cement industry was hard-pressed to supply the cement required to sustain the boom in construction during 1968. Utilization of installed capacity averaged 87 percent during the second semester and reached a maximum of 91.4 percent in September. As a result, production rose 18 percent to an annual record of 4,175,199 tons. However, actual output was exceeded by total shipments of 4,192,310 tons and end-of-month inventories fell from about 310,000 tons in January to only 147,300 tons in December. The private sector received 76.2 percent of the cement shipped, but public works consumed 33.2 percent more cement than in 1967 compared with an increase of 15.6 percent by private construction.

It was estimated that approximately 470,000 tons of cement would have to be imported during 1969 to supplement domestic production. Chile was expected to supply about 200,000 tons and most of the remainder was to be purchased from European sources.

All five of the major cement companies planned expansion at seven of their 14 plants and one new plant was under construction by another firm. Realization of all these projects as planned will add about 2.7 million tons to the annual capacity of the industry by the end of 1970. The industry hopes to complete some projects by the end of 1969 and thereby avoid a continued shortfall in demand.

Fertilizer Materials.—Petrosur, S.A.I. y C., inaugurated its modern nitrogenous fertilizer plant at Campana on the outskirts of Buenos Aires in May 1968. Mitsubishi Heavy Industries, Ltd., of Tokyo was the prime contractor for the $25 million plant. It was designed to utilize natural gas and imported sulfur, along with air and water, to produce up to 200 tons of anhydrous ammonia, 162 tons of prilled urea, 120 tons of 98-percent sulfuric acid, and 147 tons of ammonium sulfate daily. The plant also includes a unit for manufacturing polyethylene bags. In its first year of operation the Campana plant produced 18,780 tons of ammonia, 15,469 tons of urea, and 18,166 tons of ammonium sulfate.

The company has operated a fertilizer mixing and prilling plant at Rosario since May 1967. Part of the output of the Campana plant is being utilized at Rosario, along with domestic Thomas slag and imported phosphates and potassium chloride, in formulating the various NPK fertilizer mixtures produced there. Campana bags are used for packaging.

Petrosur is about 60-percent owned by Empresas Eléctricas Argentinas, a subsidiary of Ebasco Industries, Inc.; 20-percent by Shell Cía. Argentina de Petróleo, S.A.; and 20-percent by Archilnit, S.R.L. Techint, S.A., a large industrial holding company and research firm, has an equity of $500,000 in Petrosur also.

MINERAL FUELS

Petroleum and Natural Gas.—Production of crude petroleum during 1968 rose 9.4 percent. This rise followed increases of 6 percent in 1966 and 9.5 percent in 1967, indicating a measure of success in Argentina's efforts to expand crude output at a rate commensurate with domestic demand, which is expected to triple by 1980. These efforts were reinforced by a new oil policy instituted by the Government in 1967 which was designed to encourage renewed private participation in the production sector of the industry. Under this policy, the role of Yacimientos Petrolíferos Fiscales (YPF), the state oil entity, is to concentrate primarily on development drilling

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and preliminary exploration drilling in reserved onshore areas where the potential for oil production is reasonably well known, while the major part of the exploration of untested offshore potential and a limited share of onshore exploration and development is to be concessioned or contracted to private firms. The following tabulation lists the exploration concessions awarded to private enterprises during 1968:

Location	Concession area (square kilometers)	Concessionaire
Samborombón	7,000	Kerr-McGee Corp.
	8,700	Union Oil Exploration and Production Co. and Continental Oil Co.
	9,250	Argentine Sun Oil Co., Amerada Petroleum Corp., and Marathon International Oil Co.
Río Salado	6,900	Astra-Cía. Argentina de Petróleo, S.A., and South American Development Co. (Signal Companies, Inc.).
	6,200	Do.
Bahía Blanca	15,000	Agip Argentina (Ente Nazionale Idrocarburi) and Phillips Petroleum Co. Argentina.
	10,000	Do.
	15,000	Hunt International Petroleum Co.
Golfo San Jorge	2,700	Sinclair Oil Co. of Argentina.
	4,800	Agip Argentina, Phillips Petroleum Co. of Argentina, and Tennessee Argentina, S.A., (Tenneco Oil Co.).
	4,900	Do.
	4,850	Tennessee Argentina, S.A.
Río Autel	4,100	Esso (Argentina), Inc.
	2,900	Sinclair Oil Co. of Argentina.
	3,200	Do.
	6,000	Do.

The Government officially awarded the first exploration concessions under the new Hydrocarbons Law in January 1968. These included three adjoining offshore areas east of Bahía Blanca, three adjoining offshore areas in and south of Bahía Samborombón southeast of Buenos Aires, and two contiguous onshore coastal areas in the Río Salado Basin north of Mar del Plata. The terms of these concessions varied considerably with respect to the length of initial exploration periods and possible subsequent renewals as well as to expenditures committed for the various periods. Altogether, the companies were committed to spend in excess of $25 million during the initial exploration periods, which reportedly ranged from as low as 1.5 years up to 5 years in length.

In August 1968, Sinclair Oil Co. was awarded three exploration concessions and Esso won another in the Río Autel area in southwestern Mendoza Province and adjoining parts of San Luis and La Pampa Provinces. Sinclair agreed to minimum expenditures of $9,995,000 during the first 4-year period and a total of $6,300,000 during the subsequent 3-year and 2-year renewal periods. Esso was committed to spend $2,300,000 during the first period and a total of $3,400,000 during the renewal periods.

In September, the Government awarded four exploration concessions in the Golfo San Jorge offshore from Comodoro Rivadavia. Three other areas offered were not bid on, apparently because of unfavorable prospects indicated by preliminary seismic surveys. The concessions granted were for an initial period of 3 years with renewal periods of 3 years and 2 years. The winning bidders were committed to minimum expenditures totaling $16,379,000 for the first period and $14 million during the following two periods.

Another avenue for private participation in the industry was opened during the year as YPF began calling for bids on exploration and development ventures in "semiproved" areas under its jurisdiction. Under a tender open only to bidding by Argentine firms, Cía. Naviera Pérez Companc, S.A., won a 15-year contract with an optional 5-year extension to explore and develop the Entre Lomas area astride the border between Neuquén and Río Negro Provinces where YPF already had drilled nine successful wells. Pérez Companc will bear all exploration and development costs and will sell the oil produced to YPF. Development of this potentially 60-million-barrel field will require drilling about 270 wells, 17 of which were completed by the contractor by yearend.

Although no other such contracts were awarded during the year, bidding was called on a number of other "semiproved" YPF areas, including the Colonias Las Heras area southwest of Comodoro Rivadavia and the Cerro Redondo and El Condor areas at the southern edge of Santa Cruz Province. The tender for development drilling in the latter two areas included construction of

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a 415-mile gas pipeline to link the fields to the existing 1,000-mile gas pipeline from Pico Truncado to Buenos Aires. Crude oil produced in 1968 from the Cerro Redondo and El Condor fields was transported by pipeline to the Chilean terminal at San Gregorio on the Magellan Strait.

According to YPF, drilling during 1968 totaled 941,265 meters, with 518 holes being completed and four abandoned for technical reasons. Of the total number of holes, 361 were drilled by YPF, 85 by contractors for YPF, and 76 by private producers operating under exploitation contracts with YPF. Of a total of 416 development wells drilled, 295 were indicated as oil producers, 30 as gas wells, and 91 as dry holes. Out of 102 exploration wells completed, 14 were reported as oil producers and nine as gas wells.

Successful YPF wildcat holes in four areas were considered to be particularly significant. Exploratory drilling in the west-central part of Mendoza Province located a promising new field known as Estructura Cruz de Pedra. Three important wildcats were successfully completed in an area south of the large Catriel field in the northern part of Río Negro Province. In the adjoining part of Neuquén Province to the west, two potentially important new oil producers and several new gas wells were completed. Also, significant gas accumulations were discovered at Chimen Aike, Muy Aike, and Río Chico Sur in the vicinity of Río Gallegos in the southern part of Santa Cruz Province.

Geophysical exploration by YPF in 1968 included 7,807 kilometers of profile surveyed by 22 seismic parties, gravity surveys of 10,650 square kilometers, and aeromagnetic surveys of 110,000 square kilometers in Neuquén, Río Negro, Mendoza, La Pampa, and Santa Cruz Provinces in conjunction with the Naval Hydrographic Service. In addition, reconnaissance parties mapped the geology of 8,400 square kilometers, the geology of 91,560 square kilometers was plotted on the basis of photointerpretation, and 108 party-months were devoted to topographic work. Private companies completed a total of 30 party-months of seismic surveys, including 14 party-months of surveying in the Río Salado land area and eight in the Bahía Blanca, four in the Samborombón, and four in the San Jorge offshore areas.

Crude oil production during 1968 (366 days) was at a record average rate of about 342,900 barrels per day, compared with an average of 314,200 barrels per day in 1967. YPF contributed 75.8 percent of the total with an output of 95.1 million barrels, an increase of 8.4 million barrels over its 1967 output. Pan American Argentina Oil Co. increased its production 2.3 million barrels to 12.7 million barrels or about 10.1 percent of the national total. Nearly 96 percent of Pan American production was from wells in Chubut Province and the remainder from Santa Cruz Province. Output by Argentina-Cities Service Development Co., the only other major producer (11.9 percent), declined nearly 900,000 barrels to 14.9 million barrels, as the normal yield of the company's fields in Mendoza Province continued to fall.

Table 5.—Argentina: Production of crude oil and natural gas by Province

Province	Crude oil (thousand barrels)			Natural gas [1] (million cubic feet)		
	1966	1967	1968	1966	1967	1968
Santa Cruz	32,130	34,148	35,884	86,405	105,073	117,668
Mendoza	29,204	34,251	37,117	3,211	3,563	3,643
Chubut	17,981	19,499	21,847	13,271	15,440	15,543
Río Negro	13,187	15,797	17,274	6,256	9,798	11,209
Salta	4,737	4,149	4,216	85,724	79,315	83,863
Neuquén	4,229	4,357	7,189	12,847	12,854	15,526
Tierra del Fuego	3,291	2,474	1,955	2,863	2,376	2,088
La Pampa	---	---	6	---	---	---
Total [2]	104,760	114,673	125,488	210,576	228,419	249,486

[1] Gross withdrawal. Converted from cubic meters at rate of 1 cubic meter equals 35.3145 cubic feet.
[2] Data may not add to totals shown because of independent rounding.

Source: Dirección Nacional de Energía y Combustibles.

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In an effort to stem the declining trend in its production, Cities Service began an injection program in December to repressure the Punta de las Bordas, Vacas Muertas, and Gran Bajana Blanca fields. Repressuring is expected to boost production from about 30,000 to about 50,000 barrels per day, and recovery is expected to rise from 34 percent to 40 percent of original in-place oil with an estimated additional yield of about 25.6 million barrels. Cities Service also was installing a huge, skid-mounted 60,000-barrel-per-day automatic-custom-transfer unit to transfer oil from its Mendoza fields to the pipeline linking the area to the Lujan de Cuyo refinery.

Under contracts negotiated by YPF in 1967, secondary recovery programs were started at the Cerro Bandera and El Sauce fields in Neuquén Province. YPF continued its water injection projects in the Barrancas Sur field in Mendoza and the Cañadón Leon field in Santa Cruz Provinces and began another water injection project at the Medanito field in Río Negro Province. The company also called for bids to undertake secondary recovery operations in three of 10 fields where technical studies had been made and for the installation of pilot plants in three others.

Provisional data for 1968 indicated total refinery runs of crude oil amounted to approximately 137,654,400 barrels, 5 percent greater than the 1967 throughput of 131,143,000 barrels. Runs of domestic crude increased 8.5 percent to about 122,450,700 barrels and those of imported crude decreased 17 percent to about 15,203,700 barrels. Nearly 58 percent of the total crude throughput was processed by seven refineries operated by YPF, about 21.5 percent by the Dock Sud refinery of Shell Cía. Argentina de Petróleo, S.A., about 18 percent by two refineries operated by Esso S.A. Petrolera Argentina, and the remainder by five small privately owned refineries.

YPF awarded a $21 million contract to the consortium Lummus Española, S.A., and Mellor-Goodwin, S.A.C., for expansion of the Luján de Cuyo refinery near Mendoza. Expansion of capacity from about 45,000 to 100,000 barrels per day will enable YPF to process the increasing supply of crude oil being produced in the Mendoza area. A new products pipeline is being built from this refinery to Córdoba by a consortium headed by Bechtel Corp. The first stage of the line from Luján to Villa Mercedes was expected to be completed early in 1969 and the connection of the second stage to the Campo Duran-San Lorenzo pipeline at Monte Cristo near Córdoba was scheduled for 1970.

Shell began a program to modernize and expand its Dock Sud refinery in Buenos Aires. The project is scheduled for completion in 1971 and includes distilling, platforming, hydrotreating, and sulfur recovery units.

At La Plata, southeast of Buenos Aires, expansion of the YPF refinery capacity from 140,000 to about 215,000 barrels per day and construction of a 1.2 million-barrel-per-year lubricants plant were well advanced at yearend and the projects were scheduled for completion during 1969.

A crude oil pipeline 32 inches in diameter and 230 kilometers long is to be constructed from the La Plata refinery to Cabo Santo Antonio where new unloading and storage facilities are to be built. At the latter terminal, two mooring buoys will be installed for offshore unloading of tankers up to 70,000 gross tons. Underwater pipelines will carry the crude oil from the buoys to land storage tanks that will have a total capacity of 200,000 cubic meters. This new unloading and transport system also will be linked with the 33-inch La Plata-Buenos Aires pipeline which was completed during 1968. Bechtel Corp. and Victor Contreras, S.A., were selected to form a joint enterprise with YPF to carry out this $50 million project, and its completion was scheduled for the latter part of 1970.

In July, Gas del Estado, the state-owned gas company, signed a contract with Bolivia's Yacimientos Petrolíferos Fiscales (YPFB) and Bolivian Gulf Oil Co. for the purchase of large quantities of Bolivian natural gas by Argentina. The agreement covers a span of 20 years starting with initial gas deliveries about mid-1970. The contract calls for the delivery of about 140 million cubic feet of gas daily during the first 7 years and 157 million cubic feet daily during the next 13 years, and its total value was estimated at approximately $300 million. YPFB and Gulf will share equally in providing the gas and in the cost of a $46.5 million gas pipeline from fields in the Santa Cruz area of Bolivia to the Argentina boundary at Yacuiba. This 24-inch, 600-kilometer line will be connected with the existing 1,744-kilometer line from Campo Duran to Buenos Aires.

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The Mineral Industry of Australia

By Lester G. Morrell [1]

Again in 1968 Australia's mineral industry recorded substantial increases in development activity, output of products, and value of mineral exports. According to early estimates, the $920 million [2] value of mine and quarry products, together with value added by local smelting and processing facilities, credits the mineral industry with products valued at $1.25 billion. This represents a record 4.6 percent of the gross national product, compared with an average of 3.8 percent for the preceding 4 years. Since 1959, value of minerals output, in constant dollars, has more than doubled. The growing role of minerals in the national economy is summarized for recent years in the accompanying tabulation:

	1964	1965	1966	1967	1968[p]
Gross national product (GNP)[1]---value, millions	$20,184	$22,219	$23,392	$25,516	$27,194
Mineral industry output [2]---do	$746.5	$816.6	$867.9	$1,092.6	$1,254.0
Index of manufacturing production [1] (1959/60 =100)	126	138	143	153	160
Index of mineral output (1959 =100)	128	137	156	178	204
Total labor force---thousand persons	3,461	3,604	3,703	3,775	3,903
Employees, mines and quarries---do	48.1	49.4	52.3	53.8	56.7
Total merchandise exports [1]---value, millions	$3,014.3	$2,840.2	$2,887.6	$3,217.1	$3,205.2
Mineral commodity exports [3]---do	$268.8	$348.6	$403.6	$518.9	$726.8
Total merchandise imports [1]---do	$2,657.4	$3,182.3	$3,246.1	$3,864.4	$3,600.8
Mineral commodity imports [3]---do	$285.6	$340.2	$313.5	$343.9	$359.6

[p] Preliminary.
[1] For fiscal year ending June 30 of year stated.
[2] Mine value plus value added by domestic primary treatment.
[3] Ores, concentrates, alumina and other semiprocessed materials, and primary metals including gold.

In 1967, the most recent year for which value details are available, metals accounted for 53 percent of the total value of minerals output. The value of coal amounted to 29 percent and nonmetallic and construction materials 18 percent. The 10 leading commodities, in order of value, in million dollars, were as follows: Coal, 202.5; construction materials (total), 103.0; iron ore, 93.1; copper, 84.9; lead, 82.3; bauxite, 40.0;[3] zinc, 33.0; silver, 30.6; gold, 28.0; and titanium (rutile and ilmenite) concentrates, 27.4.

Although all six States and the Northern Territory contributed, New South Wales with its large base metals and coal industries furnished 39.5 percent of the national total. Queensland's aluminum raw material and coal resources ranked that State in second place with 19.4 percent, and Western Australia, the principal iron ore and gold State, was a close third, accounting for 19.2 percent of the year's output. Victoria, South Australia, Tasmania, and Northern Territory contributed respectively 8.2 percent, 5.8 percent, 5.0 percent, and 2.8 percent.

Substantial quantitative increases in output were recorded for bauxite and alumina, bismuth, copper, iron ore, manganese ore, beach sand minerals, zinc, gypsum, black coal, and petroleum. Moderate declines were reported in gold, in refinery output of lead and several of its coproduced minor

[1] Mining engineer, Division of International Activities.
[2] Unless otherwise indicated, values have been converted from Australian dollars (A$) to U.S. dollars at the rate of A$1 equals US$1.12.
[3] Values of bauxite and alumina production are not given in Australian statistics. A nominal value, based on United States price, f.o.b. mines, has been applied.

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metals, and in a few nonmetals. Generally strong market conditions and price increases as reflected in the 1968 wholesale price index of 398 (compared with 396 in 1967) for metals and coal, were important factors in the year's record output.

Exclusive of operations employing fewer than four persons, 873 mines and quarries worked during 1967, including 162 metal, 135 nonmetal, 155 coal mines, and 421 construction material quarries. Total wage and salary payments to the 46,317 workers at these mines and quarries totaled A$183.4 million. Value of additions and replacements to fixed assets amounted to $187.8 million in 1967 ($167.6 million in 1966). New capital expenditures by the mining and mineral processing industries totaled $516.8 million in 1967, compared with $476.3 million in 1966. Private oversea investment in mines and quarries dropped from $47 million in the 1965–66 fiscal period to $41 million in 1966–67, and foreign expenditures on petroleum were down from $137 million to $108 million.

Commonwealth Government financial assistance to the minerals industry during recent years has been as follows:

	Value (thousands)		
	1966	1967	1968
Petroleum exploration [1]	$11,374	$11,549	$15,462
Gold mining [2]	4,238	4,322	3,155
Sulfuric acid production [3]	1,566	1,548	1,432
Phosphate fertilizer production [4]	28,916	28,609	27,896
Total	46,094	46,028	47,945

[1] Petroleum Search Subsidy Act.
[2] Gold Mining Industry Assistance Act.
[3] Sulfuric Acid Bounty Act.
[4] Phosphate Fertilizers Bounty Act.

Of significance principally to the petroleum industry, joint Commonwealth-State legislation applicable to offshore areas including territorial waters and Continental Shelf came into effect on April 1, 1968. The basic law, known as the Petroleum (Submerged Lands) Act of 1967, provides a uniform code for administering mineral concessions and titles off all State and Territorial coasts.

The dynamic pace of exploration and development of the mineral industry continued throughout 1968. According to a recent census,[4] more than 60 Australian companies were linked with 116 oversea firms in exploration on development activities. The oversea partners included 5[illegible] United States companies, 20 Canadian, 1[illegible] British, 16 Japanese, and others from Republic of South Africa, Switzerland, France, Belgium, and Malaysia. (The lists do not include companies in the oil search.)

Through corporate ties and subsidiaries virtually all of the world's great aluminum companies are participating in the development and exploitation of Australia's bauxite resources. Known and inferred reserves on Cape York and Gove Peninsulas in northeastern Australia and in the Darling Ranges and Admiralty Gulf regions of Western Australia are regarded as one-fourth to one-third of the world's known supply.

Two iron ore companies, Hamersley Iron Pty. Ltd., Western Australia, and Savage River Mines, Tasmania, commenced shipments of pellets in 1968 and a third pellet plant, part of the new steel project at Kwinana, Western Australia, was commissioned during the year. The big Mount Newman operation started ore shipments in April 1969. Western Mining Corporation, Australia's first nickel producer, operated at capacity and announced plans during the year to build a domestic refinery.

Under the impetus of long-term contracts to supply Japanese coal requirements, mines, railroad, and port construction programs are proceeding in Queensland and New South Wales. Expansion plans that will double the output of manganese ore from Groote Eylandt, in the Gulf of Carpentaria, were announced; and feasibility studies aimed at exploiting the extensive phosphate rock deposits at Duchess and Lady Annie, in Queensland, were continued in 1968. Petroleum exploration and development activities continued at a high rate in Western Australia, Queensland, Victoria, and offshore areas. Although gold mining has been in a general decline, the opening of the Juno mine at Tennant Creek, Northern Territory, in 1968 has not only bolstered gold production but has substantially increased Australia's output of byproduct bismuth.

The Department of National Develop-

[4] American Chamber of Commerce in Australia. United States and other oversea firms currently engaged in search for and development of metals, minerals in Australia. Melbourne, October 1968.

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nent recently published[5] data on national eserves of major mineral products. The uantities were derived primarily from company statements which in turn are based on recognized technologic standards and hence may be regarded as conservative.

Mineral	Unit	Quantity (thousands)	Comment
auxite	Long tons	4,000,000	Indicated 2,500 million, inferred 1,500 million.
oal:			
Black	do	4,400,000	New South Wales, 3,000 million; Queensland, more than 1,200 million.
Brown, lignite	do	98,230,000	Measured, indicated and inferred in Victoria, plus 530 million measured and indicated in South Australia.
opper	do	2,200	Metal content, reported by main producers.
old	Troy ounces	35,300	Minimal reserves of principal producers of gold ores, 34 million; copper ores, 1.3 million.
on ore	Long tons	20,000,000	Pilbara region, Western Australia only. Average of various estimates.
ead	do	13,000	Metal content. Includes 8 million at McArthur River, Northern Territory prospect.
Manganese ore	do	51,000	Groote Eylandt, not all marketable, 50 million. 1 million measured in Pilbara region, Western Australia.
Mineral sands:			
Ilmenite	do	15,000	Recoverable.
Rutile	do	6,000	Do.
Zircon	do	7,500	Do.
Nickel	do	2,000	Metal content, includes sulfide ores, 500,000 laterites, 1.5 million, all in Western Australia.
Phosphate rock	do	1,350,000	Medium grade, all in northwest Queensland.
Silver	Troy ounces	290,000	Minimal reserves of principal producers.
Tin	Long tons	112	Metal content, known, recoverable.
Tungsten	do	19	WO_3 content. Minimal.
Uranium	Short tons	17	U_3O_8 content. Minimal, recoverable.
Zinc	Long tons	23,500	Metal content. Includes 18 million at McArthur River, Northern Territory prospect.

PRODUCTION

In both value and volume Australia's mineral production recorded substantial gains in 1968. Preliminary estimates indicate an annual value increase of 14.8 percent, or slightly higher than the average 13.9 percent of the preceding 3 years. Although the country's mineral diversity includes over 70 products, of the 55 items for which 1968 quantitative data are available, annual increases were recorded in 36. Commodities that showed decreases during the year included gold, brown coal, a few minor metals, and several nonmetallic materials.

[5] Hansard (official gazette of the Australian Commonwealth Parliament). Mineral Reserves. Question No. 519, May 22, 1969, pp. 1474–1475.

Table 1.—Australia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite	796,482	1,186,412	1,827,123	4,243,583	4,958,139
Alumina	160,659	202,446	306,970	854,420	1,309,461
Refined metal	80,008	87,765	91,863	92,792	97,348
Antimony (in antimony and lead concentrates)	1,134	959	987	945	844
Beryl	113	40	53	56	• 30
Bismuth (in ore)kilograms			325	11,583	• 185,000
Cadmium, refined metal	502	524	526	524	459
Chromite	73	23		140	NA
Cobalt (in zinc and nickel concentrate)	74	91	r 85	148	• 200
Columbium and tantalum concentrate	15	12	5	23	• 120
Copper:					
Ore and concentrate (content)	105,720	91,839	r 111,295	91,701	106,788
Blister (primary)	81,882	74,592	91,939	71,963	93,005
Refined (primary)	81,199	60,918	91,404	67,154	85,140

See footnotes at end of table.

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Table 1.—Australia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS—Continued					
Gold—troy ounces	963,834	877,643	r 916,985	801,009	796,63[illegible]
Iron and steel:					
Iron ore—thousand tons	5,759	6,803	r 11,068	17,309	26,40[illegible]
Pig iron—do	3,993	4,251	4,743	5,057	5,57[illegible]
Ferroalloys:[1]					
Ferrochromium, high-carbon	2,480	1,358	1,781	2,217	NA
Ferromanganese and silicomanganese	47,997	56,901	56,335	76,313	NA
Ferrosilicon	5,095	4,475	r 4,293	8,948	NA
Steel ingots and castings—thousand tons	5,047	5,462	5,890	6,201	6,43[illegible]
Steel semimanufactures [1]—do	3,606	4,615	4,607	5,250	NA
Lead:					
Ore and concentrate (content)	380,872	367,949	r 370,755	381,050	387,878
Refined (primary)	206,360	196,409	196,228	193,926	178,044
Bullion, for export	79,561	67,981	75,487	102,791	108,257
Manganese ore, all grades	62,090	r 101,980	r 317,556	557,546	749,441
Molybdenum, in ore and concentrate	---	r 22	r 4	---	---
Nickel, in ore and concentrate	---	---	---	2,094	4,606
Platinum—troy ounces	---	---	13	---	---
Selenium (in refinery slimes) e—kilograms	1,590	2,380	2,000	NA	NA
Silver:					
Ore and concentrate (content)—thousand troy ounces	18,427	17,281	r 18,888	19,783	21,618
Refined—do	9,258	8,696	r 9,155	10,156	9,426
Tellurium (in refinery slimes) e—kilograms	1,600	---	---	---	---
Tin:					
Ore and concentrate (content)—long tons	3,642	3,849	r 4,807	5,600	6,628
Smelter—do	3,021	3,179	3,640	3,594	3,692
Titanium concentrates:					
Ilmenite (includes leucoxene)	309,168	448,499	522,013	548,338	558,946
Rutile	185,298	220,818	r 247,772	277,813	298,625
Tungsten ores and concentrates (W content)	802	948	1,053	963	1,148
Uranium oxide (U_3O_8) e	335	335	300	300	300
Zinc:					
Ore and concentrate (content)	350,131	354,836	r 375,269	405,995	420,402
Smelter	188,509	202,182	197,530	197,593	208,780
Zirconium concentrate	187,087	230,504	r 289,431	299,483	314,884
NONMETALS					
Asbestos:					
Chrysotile, fiber and fines	r 1,503	1,063	569	544	812
Crocidolite	10,785	9,428	r 11,649	122	---
Barite	12,499	12,168	13,943	15,917	e 16,000
Cement—thousand tons	3,626	3,802	3,674	3,817	3,930
Clays:					
Bentonite and bentonite clay	1,015	r 1,206	r 828	363	NA
Brick clay and shale—thousand tons	5,164	5,137	r 5,200	5,898	NA
Cement clay and shale—do	282	257	r 243	162	NA
Damourite clay	576	r 784	r 541	498	e 500
Fire clay—thousand tons	225	237	291	258	NA
Kaolin and ball clay—do	46	62	51	67	e 65
Other—do	r 506	r 468	r 553	539	NA
Diatomite	8,872	7,070	r 7,263	8,449	e 2,300
Feldspar	9,157	8,864	7,376	4,521	e 4,500
Fertilizer materials, phosphate rock	5,780	4,592	5,807	11,959	5,836
Fuller's earth	162	90	---	76	NA
Gem stones e—value, thousands	$3,469	$4,404	$4,653	$4,106	NA
Gypsum	799,126	846,898	r 814,417	789,860	833,000
Lime [2]	102,872	161,201	151,902	190,592	e 190,000
Lithium minerals [3]	264	315	1,009	678	750
Magnesite	31,752	26,785	19,870	24,033	e 24,000
Monazite concentrate	2,013	2,342	r 2,016	2,952	3,257
Pyrites, including cupreous pyrites	223,610	207,285	249,946	256,805	e 170,000
Salt—thousand tons	554	665	655	714	NA
Talc and soapstone	17,033	19,695	r 21,883	20,873	e 40,000
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous [4]—thousand tons	27,841	31,937	33,869	35,265	40,954
Lignite (brown coal)—do	19,340	r 20,659	22,135	23,759	23,432
Coke:					
High-temperature—do	3,092	3,096	3,235	3,407	3,955
Low-temperature [5]—do	779	749	662	626	e 660
Fuel briquets—do	1,885	1,935	1,889	1,875	1,578
Natural gas—million cubic feet	106	144	143	152	216
Petroluem:					
Crude—thousand 42-gallon barrels	1,491	2,622	3,390	7,600	13,877

See footnotes at end of table.

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Table 1.—Australia: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968p
MINERAL FUELS AND RELATED MATERIAL —Continued					
Petroleum—Continued					
Refinery products:					
Gasoline thousand 42-gallon barrels	40,809	43,901	46,704	52,826	56,397
Kerosine and jet fuels ---do---	4,459	4,224	5,778	7,232	8,248
Distillate fuel oil ---do---	19,549	20,095	22,041	25,844	28,850
Residual fuel oil ---do---	33,493	34,580	37,929	40,737	44,728
Lubricants ---do---	1,400	1,805	1,868	2,291	2,402
Other products ---do---	5,366	7,523	8,648	8,591	6,676
Refinery fuel and loss ---do---	9,809	11,441	12,373	13,415	16,288
Total ---do---	114,885	123,569	135,341	150,936	163,589

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Ferroalloys and steel semimanufactures are reported for fiscal years ending November 30.
[2] Year ended June 30 of year stated.
[3] Petalite, amblygonite, and spodumene.
[4] Includes semianthracite and subbituminous.
[5] Includes coke breeze.

TRADE

The following import and export summaries, provided by Commonwealth Bureau of Census and Statistics, cover the official July 1–June 30 annual reporting period and hence are not precisely comparable with calendar year data presented elsewhere in this review.

Table 2.—Australia: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal destinations, 1966–67
METALS			
Aluminum:			
Bauxite	NA	NA	
Scrap	1,512	1,388	Japan 912; Netherlands 215; West Germany 152.
Unwrought	19,079	19,116	Japan 3,932; India 3,818; Hong Kong 2,464.
Semimanufactures	2,379	11,325	United States 7,903; Canada 1,662.
Beryllium ore and concentrate	62	604	United States 374; Japan 230.
Cadmium, refined metal [2]	503	682	New Zealand 272; United Kingdom 166; United States 165.
Copper:			
Ore and concentrate, gross weight	42,634	38,924	All to Japan.
Blister, cement, etc	5,638	7,858	Do.
Scrap	2,646	77	Spain 48; Japan 29.
Ingots, blocks, billets [3]	26,844	3,666	Netherlands 2,001; Japan 525; United States 509.
Semimanufactures	16,535	6,162	New Zealand 5,386.
Pipe, tubes, and wire	2,984	1,893	New Zealand 1,197.
Gold:			
Ore and concentrate, troy ounces content. [4]	83,533	159,697	NA.
Crude bullion, content ---do---	1	61,280	Hong Kong 60,544.
Mint bullion ---do---	768,702	348,653	All to Hong Kong.
Sheet, strip, dust ---do---	9,625	166,481	Hong Kong 153,936.
Iron and steel:			
Iron ore and concentrate	343,279	5,556,154	Japan 5,164,916.
Iron pyrites and cinder	71,195	---	
Scrap	269,314	409,597	Japan 334,012; Taiwan 42,781.
Pig iron	50,630	131,834	Japan 68,806; Philippines 13,656.
Steel ingots, blooms, slabs, etc	82,040	371,294	Pakistan 90,626; Philippines 63,424; Japan 52,048.
Steel semimanufactures	482,667	810,868	New Zealand 247,183; United States 137,773.

See footnotes at end of table.

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Table 2.—Australia: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal destinations, 1966–67
METALS—Continued			
Lead:			
Ore and concentrate, gross weight	120,151	110,743	United States 36,541; Belgium-Luxembourg 26,166; Japan 23,195.
Refined, unwrought	162,374	154,586	United Kingdom 54,225; United States 52,401.
Bullion, lead and silver lead	90,551	82,214	United Kingdom 59,610; Netherlands 11,682.
Semimanufactures	5,563	3,462	New Zealand 1,835; Philippines 711; Japan 383.
Manganese ore	70,139	275,881	Japan 247,519.
Platinum-group metals:			
Ore and concentrate, gross kilograms weight. [3]	7,277	---	
Platinum metals [3] troy ounces	1,538	55,181	Undisclosed 45,774; United Kingdom 3,489.
Silver:			
Ore, concentrate, crude bullion, content. [4] thousand troy ounces	7,371	8,299	NA.
Mint bullion do	247	2,182	United Kingdom 1,946.
Sheet, strip, dust do	178	543	Japan 427; New Zealand 110.
Tantalite-columbite concentrate	7	28	United States 23; United Kingdom 5.
Tin:			
Ore and concentrate, gross weight. long tons	2,019	2,560	United Kingdom 1,117; Spain 707; Malaysia 326.
Unwrought do	15	16	Destination undisclosed.
Titanium concentrates:			
Ilmenite, minimum 45 percent TiO_2	395,545	388,472	United Kingdom 184,832; France 73,740; Japan 52,831.
Rutile, minimum 90 percent TiO_2	238,116	248,469	United States 137,531; Japan 26,161.
Tungsten concentrates:			
Scheelite	1,321	1,175	West Germany 509; Republic of South Africa 234; Netherlands 188.
Wolframite	569	480	United States 239; Republic of South Africa 121; United Kingdom 64.
Zinc:			
Ore and concentrate, gross weight	247,756	254,519	United Kingdom 149,551; Japan 63,406.
Ingots, blocks, slabs, etc	100,774	115,868	India 18,440; United States 15,999; United Kingdom 13,565; Thailand 12,405.
Semimanufactures	891	489	New Zealand 265; Japan 91.
Other forms	225	2,109	Netherlands 1,208; Japan 241; Belgium-Luxembourg 209.
Zircon concentrate, minimum 30 percent $ZrSiO_4$.	224,541	237,142	United States 77,927; Japan 49,579; United Kingdom 28,453.
NONMETALS			
Abrasives:			
Industrial diamonds [3] carats	44,159	40,194	United Kingdom 25,827; Philippines 10,231.
Other natural abrasives	104	---	
Asbestos, crude and fiber [5]	3,983	3,736	Singapore 1,125; Malaysia 1,011; India 480.
Cement, construction types	2,738	2,124	Undisclosed 947; Nauru 822.
Clay, fire, sillimanite and others	2,949	3,323	Japan 1,683; United Kingdom 820; Papua and New Guinea 766.
Gem stones:			
Diamonds [3] carats	2,334	1,615	United Kingdom 723; Belgium-Luxembourg 402; United States 187.
Opal [3] value, thousands	$6,856	$8,122	Japan $3,182; Hong Kong $3,182; United States $834.
Other, cameo, intaglio do	$979	$1,864	United States $1,040; Japan $225.
Graphite	22	---	
Gypsum	187,409	242,706	New Zealand 108,287; Taiwan 46,100; Philippines 44,310.
Magnesite	2,306	1,879	United States 924; New Zealand 817.
Mica	29	---	
Monazite concentrate	2,369	2,357	United States 1,199; West Germany 383; France 310.
Salt	102,936	94,382	Japan 80,060.
Stone, construction value, thousands	$35	---	
Talc and steatite	9,992	5,418	Netherlands 3,375; New Zealand 1,272.

See footnotes at end of table.

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Table 2.—Australia: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal destinations, 1966–67
MINERAL FUELS AND RELATED MATERIALS			
Coal, thousand tons	7,777	8,946	Japan 8,532.
Coke and semi-coke	112,202	81,349	New Caledonia 66,869; Philippines 8,685.
Petroleum refinery products:			
Gasoline, total, thousand 42-gallon barrels	454	1,150	New Zealand 465; Singapore 147.
Kerosine and jet fuel, do	594	456	New Zealand 282; Fiji 119.
Distillate fuel oil, do	1,366	2,957	Singapore 778; United Kingdom 593; Mozambique 361.
Residual fuel oil, do	3,839	3,275	New Caledonia 1,230; Singapore 1,124; Japan 629.
Lubricants, do	443	648	New Zealand 190; Singapore 156; Republic of South Africa 126.
Other products, do	108	327	New Zealand 184; United Kingdom 90.

NA Not available.
[1] Periods shown are fiscal years July 1 to June 30.
[2] Data not available on quantities of cadmium exported in lead and zinc concentrates.
[3] Includes reexports.
[4] Quantities given are for 1965 and 1966 calendar years, respectively.
[5] Mostly crocidolite.

Table 3.—Australia: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal sources, 1966–67
METALS			
Aluminum:			
Scrap	996	1,228	New Zealand 532; Canada 203; United States 203.
Pigs, ingots, blocks, etc	396	452	United Kingdom 289; United States 88.
Semimanufactures	3,465	3,053	United States 1,269; United Kingdom 891; West Germany 453.
Pipe, tubes, powder, wire	381	904	United States 583; United Kingdom 124.
Antimony metal	189	20	All from mainland China.
Arsenic trioxide	1,217	1,523	Sweden 1,114; France 283.
Bismuth metal	8	7	Japan 4; United Kingdom 2.
Chrome ore and concentrate	12,233	23,392	Philippines 13,717; Iran 7,620.
Cobalt and cobalt base alloys	53	78	Zambia 43; Congo (Brazzaville) 15; Congo (Kinshasa) 7.
Copper:			
Ore and concentrate	932	2,205	Canada 2,195.
Scrap	143	597	New Zealand 424; Papua and New Guinea 68.
Ingots, blocks, billets	935	3,127	Zambia 2,251; Belgium-Luxembourg 525.
Semimanufactures	1,392	679	United Kingdom 604.
Pipe, tubes, powder, wire	920	2,050	United States 1,131; Japan 415; United Kingdom 387.
Gold:			
Crude bullion, gold content, troy ounces	147,016	147,902	Fiji 108,244; Papua and New Guinea 39,653.
Refined bullion, do	50,732	3,890	Papua and New Guinea 3,213; West Germany 497.
Iron and steel:			
Ore and concentrates, includes pyritic materials.	288,315	207,331	New Caledonia 207,221.
Scrap	1	17	NA.
Ferroalloys:			
Ferrochromium	3,259	2,799	Japan 1,998; Republic of South Africa 625.
Ferromanganese	11,866	5,689	Republic of South Africa 5,191.
Ferromolybdenum	248	196	United States 87; Belgium-Luxembourg 60.
Ferrosilicon	10,534	9,773	Republic of South Africa 5,982; Norway 2,746.
Ferronickel	1,097	1,248	New Caledonia 997; France 243.
Other	1,599	1,091	Sweden 371; Republic of South Africa 276; Japan 176; United Kingdom 155.

See footnotes at end of table.

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Table 3.—Australia: Imports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal sources, 1966–67
METALS—Continued			
Iron and steel—Continued			
Ingots, blooms, etc	6,422	6,905	Italy 4,043; Japan 2,667.
Semimanufactures	368,135	190,003	Japan 126,634; United Kingdom 33,931.
Pipes, tubes, castings and forgings	58,701	57,974	Japan 26,637; United Kingdom 16,514.
Lead and lead base alloys	72	44	NA.
Magnesium and magnesium base alloys	900	1,044	Norway 294; Canada 287; United States 189.
Manganese ore:			
Battery grade	1,296	1,091	Ghana 996.
Metallurgical grade	33,596	6,397	Mainland China 4,053; Republic of South Africa 1,938.
Mercury—76-pound flasks	1,345	1,868	Spain 1,075; Italy 338.
Nickel:			
Matte and other crude forms	468	138	United Kingdom 123.
Pigs, ingots, granulated	987	996	Canada 515; United Kingdom 275; Norway 189.
Bars, rods, anodes, powder	537	632	Canada 396; United Kingdom 114.
Platinum-group metals—troy ounces	17,839	9,374	United Kingdom 6,807; United States 2,346.
Silicon metal—value, thousands	$159	$473	Sweden $165; Japan $147.
Silver:			
Crude bullion, silver content—troy ounces	88,374	96,069	Fiji 65,977; New Zealand 16,324; United Kingdom 12,646.
Refined bullion—do	10,310	10,951	NA.
Tin and tin base alloys—long tons	511	746	Malaysia 744.
Tungsten and tungsten base alloys	18	13	Canada 6; United Kingdom 3; West Germany 3.
Zinc:			
Ore and concentrate	5,165	6,310	Iran 6,300.
Zinc and zinc base alloys	142	74	United Kingdom 51.
NONMETALS			
Abrasives:			
Industrial diamond—carats	445,597	490,794	Republic of South Africa 283,194; United States 86,325; United Kingdom 57,321.
Pumice and tripoli	1,145	1,066	New Zealand 454; United States 431.
Garnet	94	117	United States 115.
Flintstone and pebbles	356	-------	
Asbestos:			
Chrysotile	36,960	38,845	Canada 37,749.
Amosite	9,296	8,609	Republic of South Africa 8,441.
Other	2,405	2,546	Canada 2,107; United States 259.
Barite, ground and unground	1,450	1,492	Mainland China 1,182; United States 273.
Boron minerals, crude and concentrate	1,900	2,043	United States 2,036.
Cement, construction types	69,110	50,401	Japan 21,059; United Kingdom 10,362.
Clays:			
China, kaolin, pottery	27,397	24,676	United Kingdom 17,094; United States 7,524.
Fire and ball	7,814	13,145	United Kingdom 6,150; United States 3,550; Republic of South Africa 3,364.
Bentonite	16,031	14,649	United States 14,285.
Other	8,765	12,141	United States 9,615; Republic of South Africa 2,157.
Cryolite, natural and synthetic	136	173	All from Denmark.
Diatomite and other earths	5,109	5,168	United States 5,122.
Fertilizer materials:			
Nitrogenous:			
Sodium nitrate, natural	5,810	4,687	Chile 4,677.
Manufactured nitrogenous fertilizers	68,360	103,025	Japan 30,380; Canada 26,703; United States 16,472.
Phosphatic:			
Phosphate rock—thousand tons	2,840	3,324	Nauru 1,334; Christmas Island 789.
Other manufactured phosphatic materials	270	270	Japan 244.
Potassic:			
Potassic salts, natural	18	8	NA.
Manufactured potassic materials	109,868	121,842	United States 111,104.
Other and mixed fertilizers	16,438	42,202	United States 17,369; West Germany 10,470; Italy 9,352.
Fluorspar	15,778	18,272	United Kingdom 6,385; mainland China 6,232; Republic of South Africa 5,291.
Gem stones:			
Gem diamond—carats	31,747	27,334	Belgium-Luxembourg 11,376; Republic of South Africa 5,843; Israel 5,394.
Pearls and other precious and semiprecious—value, thousands	$1,457	$1,605	Japan $620.

See footnotes at end of table.

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Table 3.—Australia: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal sources, 1966–67
NONMETALS—Continued			
Gypsum, crude and calcined	864	775	United Kingdom 463; United States 214.
Graphite:			
Colloidal	25	39	United Kingdom 17; unknown 22.
Flake	166	294	Malagasy Republic 105; unknown 189.
Crystalline	186		
Amorphous	878	1,177	Ceylon 422.
Iodine, crude	9	------	
Iron oxide pigments	6,813	7,076	West Germany 3,855; Spain 1,894.
Kyanite	978	1,694	India 1,405; United States 267.
Limestone	198,852	276,270	Japan 276,263.
Lithopone	942	992	West Germany 565; United Kingdom 294.
Magnesite, crude, calcined, and fused	22,378	18,127	Japan 13,658; United States 3,582.
Mica:			
Block or sheet	34	19	All from India.
Splittings	101	78	India 64.
Ground and scrap	725	737	Republic of South Africa 210; United Kingdom 93.
Phosphorus	444	380	France 195; West Germany 100; United Kingdom 67.
Quartz and quartzite	534	480	West Germany 239; Sweden 166.
Salt	7,205	13,236	Mexico 6,096; United Kingdom 5,874.
Sillimanite	1,008	447	Republic of South Africa 353.
Stone, construction—value, thousands	$493	$457	Italy $304.
Sulfur, elemental	410,406	507,038	United States 189,537; Canada 186,299; Mexico 131,073.
Talc, steatite and chalk	11,547	11,699	France 6,972; United Kingdom 2,399; United States 2,036.
Vermiculite	2,585	2,251	Republic of South Africa 2,196.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt, bitumen and pitch:			
Natural minerals	3,770	654	United States 319.
Petroleum bitumen	193	233	United Kingdom 161.
Coal tar and coal tar pitch	9,127	10,912	United States 10,840.
Carbon and carbon black	4,733	2,906	United States 2,558; United Kingdom 305.
Coal, all types, including briquets	8,656	8,441	Republic of South Africa 7,118; United States 1,280.
Coke and semicoke	56,302	53,385	All from United States.
Peat	2,046	2,797	West Germany 2,208.
Petroleum:			
Crude—thousand 42-gallon barrels	126,345	141,598	Indonesia 34,120; Saudi Arabia 33,060; Kuwait 25,927.
Refinery products:			
Liquefied petroleum gas. 42-gallon barrels	48	1,461	United States 1,387.
Gasoline. thousand 42-gallon barrels	6,816	3,796	Aden 1,313; Iran 1,164; Singapore 1,005.
Kerosine and jet fuel—do	2,090	1,067	Aden 729; Singapore 228.
Distillate fuel oil—do	1,479	1,081	Singapore 497; Iran 220; Saudi Arabia 144; Kuwait 117.
Residual fuel oil—do	317	462	Singapore 323; New Zealand 133.
Lubricants—do	506	368	United States 197; Netherlands Antilles 122; United Kingdom 48.
Petroleum turpentine—do	50	38	Iran 19; United States 9; Singapore 6.
Other products—do	781	870	Bahrain 573; United States 130.

NA Not available.
[1] Periods shown are fiscal year, July 1 to June 30.

COMMODITY REVIEW

METALS

Aluminum.—Despite restrictions on electric power at the Camalco Aluminum (Bell Bay) Limited refinery in Tasmania, output of refined aluminum by the two Australian producers added to a national record in 1968. At the yearend, both the Bell Bay plant and the Alcoa of Australia Pty., Ltd. refinery at Point Henry, Victoria, were operating at close to their rated capacities of, respectively, 73,000 and 41,000 tons per year. Reflecting the trend of recent increased consumption by domestic fabricators, for the first time since 1963, Australia was, by a small margin, a net importer of aluminum

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ingot in 1968. Completion of expansion at Point Henry that will double plant capacity, plus the expected output of the new Alcan Australia Ltd. 50,000-ton-per-year smelter at Kurri Kurri in New South Wales, Australia's aluminum production capacity will approach 200,000 tons per year in 1970.

Backed by reserves regarded as the world's largest, development of Australia's bauxite moved ahead rapidly in 1968. Mine output rose to nearly 5 million tons of which more than half was exported during the year. Commonwealth Aluminium Corp. Ltd. (Comalco), shipped more than 3.4 million tons from Weipa, on the Cape York Peninsula. About half of this went to the Queensland Alumina Ltd. plant at Gladstone, Queensland, and the remainder was exported principally to Japan and West Germany. During the year Weipa facilities were expanded to 7 million tons capacity and construction was started on a plant to produce 100,000 tons of calcined bauxite per year.

Expansion of the alumina refinery at Gladstone from 600,000 to 900,000 tons per year was completed in December and plans for further expansion, by December 1970, to 1.3 million tons were subsequently announced.

The Grove Peninsula bauxite and alumina project, on the Northern Territory side of the Gulf of Carpentaria, underwent corporate changes in 1968 and early 1969 wherein Nabalco Pty. Ltd. (owned 50–50 by Swiss Aluminium (Alusuisse) and a group of Australian companies, headed by Colonial Sugar Refining Co. Ltd.) will be managed by the Australian interests. A revised program calls for commencing bauxite exports in July 1971 and alumina production at 500,000 tons annually by mid-1972.

Alcoa of Australia Pty., Ltd., owned 51 percent by the United States company and 49 percent by Western Mining Corp. Ltd. and other Australian companies, operates a fully integrated enterprise with mines in the Darling Ranges of Western Australia, an alumina refinery at Kwinana, a smelter at Point Henry, Victoria, and fabricating plants throughout Australia. Upon completing expansion of the Kwinana alumina plant to 630,000 tons in September, the company in December 1968 announced a program for further expansion to 1.04 million tons per year by mid-1970. Capacity of the smelter at Point Henry is also to be increased to about 82,000 tons per year. Aside from supplying domestic requirements, Alcoa is committed under long-term contracts to export alumina to Japan and the United States; and beginning in 1969, to Aluminium Bahrain, a partly owned subsidiary of British Metal Corp. in Bahrain.

Several other groups were actively interested in bauxite-based projects during the year. Amax Bauxite Corporation Ltd., a wholly owned subsidiary of American Metal Climax Inc., was considering a bauxite/alumina project on a 200,000- to 700,000-ton-per-year scale in the Admiralty Gulf area of Western Australia. Two wholly Australian companies were investigating prospects in the Darling Ranges, near Perth; and Tipperary Land Corporation, a U.S.-controlled company, was examining bauxite deposits on the Cape York Peninsula, Queensland.

Copper.—The record mine and smelter outputs of copper in 1968, respectively 12 percent and 13 percent higher than in 1967, are credited primarily to completion of mine development and plant expansion programs at Mount Isa Mines Ltd. in Queensland, permitting improved recoveries late in the year. According to midyear reports, mine output of other Australian producers was generally down from the 1967 level.

The principal copper producers and quantities of their output in recent years are summarized in table 4.

Mount Lyell Mining and Railway Co. Ltd. at Queenstown, Tasmania, in July 1968, reported discovery of a new orebody lying at a depth of 1,250 feet below the opencut that has provided most of the company's output in recent years. The new find has been estimated at 27 million tons averaging 1.46 percent copper. Concurrently announced were expansion plans tentatively estimated at $30 million that will increase mine production; and jointly with Electrolytic Zinc Co. of Australasia Ltd., provide a sulfuric acid plant based on pyrite concentrates from both companies' mines at Burnie, Tasmania.

Since 1965 Conzinc Riotinto of Australia Ltd. (CRA) has been actively investigating a large copper deposit on the Island of Bougainville, in the Territory of Papua and

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Table 4.—Australia: Major copper industry facilities

Facility	Production (metric tons of copper [1])		
	1965	1966	1967
Mines:			
Mount Isa Mines Ltd	56,321	65,159	44,475
Mount Morgan Ltd	4,746	7,932	6,874
Broken Hill field	3,222	3,084	3,583
Cobar Mines Pty. Ltd	1,910	6,048	7,781
Mount Lyell Mining and Railway Co. Ltd	13,968	15,656	16,133
Electrolytic Zinc Co. of Australasia Ltd	1,444	1,622	1,615
Ravensthorpe Copper Mines, N.L	644	591	721
Tennant Creek field	6,743	6,928	8,031
Rum Jungle field	2,909	2,906	716
Smelters:			
Mount Isa Mines Ltd	52,962	64,719	44,406
Mount Morgan Ltd	4,693	6,981	6,759
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd	3,139	6,070	5,497
Mount Lyell Mining and Railway Co. Ltd	13,799	14,169	15,301
Refineries:			
Mount Isa Mines Ltd	44,822	69,285	45,979
Electrolytic Refining and Smelting Co. of Australia Pty. Ltd	6,213	22,118	21,174
Mount Lyell Mining and Railway Co. Ltd	10,383	(2)	(2)

[1] Metal content of ore for mines; blister copper for smelters; and electrolytic for refineries.
[2] Since October 1965 all refining has been done by Electrolytic Refining and Smelting Co. of Australia Pty. Ltd.

New Guinea. In 1968 an operating subsidiary, Bougainville Copper Pty. Ltd. (two-thirds CRA, one-third New Broken Hill Consolidated Ltd.) was established, with 20-percent optional ownership rights reserved to the Territorial Administration. Ore reserves available for open-pit mining have been estimated at 772 million metric tons averaging 0.47 percent copper and 0.4 pennyweight gold per ton. An agreement negotiated early in 1969 with seven Japanese companies, calls for 965,000 metric tons of copper in concentrates over 15 years beginning in 1972. To December 31, 1968, a total of $18 million had been spent on the prospect. An additional $280 million has been estimated as the cost of completing the project for an anticipated annual production of 127,000 tons of copper in concentrates.

The great bulk of Australia's mine output of copper is smelted and refined locally. As indicated by 1966–67 data, domestic markets absorb over 90 percent of the national output of refined primary copper. Exports of copper go to many countries in forms ranging from crude ores to semifabricated and fabricated products. Shipments of copper in concentrates and other crude forms (totaling 14,400 tons in 1967) and blister and refinery shapes (totaling 16,478 tons) were predominantly to Japan.

Gold.—Continuing the trend of the past decade, gold production in 1968 was slightly below that of 1967 despite Government assistance, premium prices realized by sales in the free market and opening of the new Juno mine at Tennant Creek in the Northern Territory. A noteworthy closure of 1968 was that of the A–1 Consolidated Gold Mine in Victoria, after the 105 years of operation. Nearly 84 percent of the total mine output in 1968 was from gold mines, most of which are in the Kalgoorlie district of Western Australia. Byproduct output from copper ores accounted for 12 percent, and about 4 percent was contained in lead-zinc ores and concentrates. Western Australia was the source of 66 percent, Northern Territory 17 percent, Queensland 10 percent, and Tasmania, Victoria, and New South Wales 7 percent of the year's total.

Commonwealth Government payments under the Gold Mining Industry Assistance Act totaled $3.16 million in 1968, compared with $4.32 million in 1967. To those mines that have taken advantage of sales on overseas premium markets, the Australian Gold Producers' Association has returned an average A$2.65 premium above the fixed Australian price (A$31.25 per ounce) in 1967–68. During the fiscal period (July 1, 1967–June 30, 1968) the Association sold 559,738 ounces.

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Recoveries of gold reported by principal Western Australia producers in 1967 were as follows:

Company	Gold produced (troy ounces)
Central Norseman Gold Corp. N.L	86,478
Gold Mines of Kalgoorlie (Aust.) Ltd	152,569
Great Boulder Gold Mines Ltd	64,410
Hill 50 Gold Mine N.L	40,441
Lakeview Wiluna Gold Mines Ltd	158,012
North Kalgurli (1912) Ltd	65,302

To this list of principal producers must be added the new Peko-Wallsend Investments, Ltd., Juno mine at Tennant Creek, Northern Territory, which produced 61,189 ounces of gold in the year ending June 30, 1967. About one-third of the gold credited to the Juno mine during its first year of operation was contained in bismuth concentrate. The substantial quantity ranks this mine as Australia's leading source of bismuth.

Australia's precious metal refineries, including the Royal Mint at Perth; Engelhard Industries Pty. Ltd., Melbourne; Matthey Garrett, Sydney; and the smelters at Port Pirie and Port Kembla produced 779,314 ounces of refined gold in 1968, compared with 835,563 ounces in 1967. Sources were as follows (1967 data in parentheses), in troy ounces: New, of Australian origin—639,377 (672,171); domestic scrap—13,460 (27,276); new, of overseas origin—126,178 (136,389); imported scrap—349 (727). Imported semiprocessed gold was principally from Fiji—102,601 ounces—and Papua and New Guinea—20,157 ounces. Exports of gold in 1968, totaling 500,785 ounces, were largely in refined form, including 358,279 ounces to Hong Kong and 27,482 to New Zealand and other countries. Gold content of exported ores, concentrates, blister copper, and other materials, mostly to Japan, totaled 113,574 ounces. Domestic consumption of gold in 1967 amounted to 125,658 troy ounces.

Iron and Steel.—All sectors of Australia's iron and steel industry moved ahead in 1968, with production gains ranging from 53 percent for iron ore to 10 percent for pig iron and 4 percent for steel. Though relatively insignificant among the world's iron and steel producing countries, Australia's vast reserve of high-grade iron ore is regarded as one of the world's leading sources of raw material supply. Production has risen from less than 7 million tons in 1965 to well over 26 million tons in 1968. In fulfillment of contracts that insure markets into the 1980 decade, iron ore (lump, pellets, and fines) exports have increased from 150,000 tons in 1965 to 16 million tons in 1968. On the basis of contracts in effect on June 30, 1968 (nine Australian companies totaling 368 million tons over 20 years), exports are expected to exceed 30 million tons annually by 1972. With the exception of about 41 million tons contracted to mills in Wales and Belgium, all of the sales agreements are with Japanese steel companies.

Five companies contributed the bulk of Australia's iron ore in 1968: Savage River Mines, Tasmania—1,048,200 tons (pellets); Goldsworthy Mining Ltd., Western Australia—4,634,500 tons (crude ore); Broken Hill Pty. Co. Ltd. (BHP), two mines in Western Australia, one in South Australia—9,988,800 tons (ores, concentrates, pellets); Hamersley Iron Pty. Ltd., Western Australia—9,221,700 tons (ore and pellets), Western Mining Corp. Ltd., Western Australia—610,000 tons (crude ore). The bulk of production from the three BHP mines was for domestic use. Virtually all the rest of Australia's iron ore, including pellets made in the new BHP plant at Whyalla, South Australia, were for export to Japan. Two companies, Hamersley Iron Pty. Ltd., and Savage River Mines, began shipments from new pelletizing plants, at Dampier, Western Australia, and Port Latta, Tasmania, respectively, in April.

During 1968 the Mount Newman Consortium, a group including American Metal Climax Inc. (U.S.), Selection Trust Ltd. (U.K.), BHP, and Colonial Sugar Refining Co. Ltd. continued work on a new 265-mile railroad; and is scheduled to start shipments from Port Hedland, Western Australia, early in 1969. Long-term contracts call for totals of 100 million tons to Japan and 70 million tons to BHP plants in Australia. Of the several other companies that are developing mines and negotiating contracts the Cliffs Western Australian Mining Co. Pty. Ltd., Mount Enid-Robe River project in Western Australia is noteworthy. The corporate group includes Australian, Japanese, and United States in-

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terests with management assigned to Cleveland-Cliffs Iron Co. (U.S.). The project envisages an investment of about $240 million for mines, plants, townsite, railroad and a port facility at Cape Lambert. Financing arrangements and contract negotiations with Japanese steel companies involving supply of 123 million tons of ore and pellets over a 21-year period are reportedly close to finality.

Aside from a small tonnage of pig iron (55,200 metric tons in 1967) produced by the Wundowie Charcoal Iron and Steel Works at Wundowie, Western Australia, the BHP through subsidiaries and affiliates exercises a near monopoly of the Australian pig iron and steel industry. The BHP Company's annual reports for the years ending March 31, 1967, and 1968, record production of iron and steel primary products by BHP and its subsidiaries (Australian Iron and Steel Pty. Ltd., and Commonwealth Steel Co. Ltd.) were as follows:

Commodity	Thousand metric tons	
	1967	1968
Pig iron	r 4,929	5,429
Steel ingots and billets	6,144	6,396
Blooms and slabs	5,311	5,565
Sheets, bars, billets, etc	2,563	2,766
Plate and strip	2,217	2,256
Merchant	1,354	1,401
Rod	501	494
Narrow cold-rolled strip	67	82
Tinplate	261	260

r Revised.

Shipments of iron and steel products to overseas markets totaled 830,000 tons during the company year. Total capital expenditures during the period amounted to $165 million; however, a large part of this went to petroleum activities, iron ore, and other raw material developments, and to improving fabricating facilities. New rolling mill equipment and a continuous casting plant were commissioned at the Newcastle steelworks. New rolling lines were added at Port Kembla. In Western Australia the new blast furnace (600,000 tons annual capacity) at Kwinana, was blown in during May and the iron ore sinter plant (1 million tons per year) was commissioned late in 1968. The pelletizing plant, rated at 1.5 million tons annual capacity, started on May 11 and made its first shipments to the Port Kembla Steelworks later in the month.

Lead and Zinc.—Despite the reduced production from the Broken Hill mines, due to 4 months of labor dispute, mine output of both lead and zinc set new records in 1968, respectively 2 and 4 percent higher than in 1967. The year's output of primary lead bullion and refined lead, reflecting effects of the dispute, was down 8 percent; but the new zinc refinery which came onstream late in 1967 at Port Pirie was instrumental in contributing to the record refined zinc output in 1968.

According to 1967 data, the lead-zinc-silver mining industry included 32 mines, employing 9,703 persons. The principal centers of this activity are the Broken Hill region of New South Wales, the Mount Isa region of Queensland, and the Read-Roseberry area in Tasmania. Mine output for 1965–67, by the leading company producers, was as follows, in metric tons:

Mine	1965		1966		1967	
	Lead	Zinc	Lead	Zinc	Lead	Zinc
North Broken Hill Ltd	68,989	54,581	65,117	52,151	68,808	55,526
Broken Hill South Ltd	31,235	29,885	28,165	29,569	27,401	28,330
The Zinc Corp. Ltd	105,889	84,345	103,030	84,062	98,685	82,069
New Broken Hill Consolidated Ltd	94,116	106,418	90,428	113,423	88,565	131,978
Mount Isa Mines Ltd	50,470	31,466	66,577	44,288	78,240	51,848
Electrolytic Zinc Co. of Australasia Ltd	14,646	47,053	15,828	50,651	15,377	49,684

In 1967 (1966 figures in parentheses) the Sulphide Corp. Pty. Ltd. smelter at Cockle Creek, New South Wales, produced 20,736 (21,689) tons of lead bullion and 52,985 (52,351) tons of slab zinc. The Mount Isa Mines Ltd. smelter in Queensland recovered 84,688 (54,328) tons of lead bullion. The Broken Hill Associated Smelters Pty. Ltd. at Port Pirie, South Australia, produced 193,926 (196,228)

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tons of refined primary lead. Electrolytic Zinc Co. of Australasia Ltd. at Risdon, Tasmania, produced 144,607 (145,179) tons of refined zinc.

Completion of the expansion programs at Mount Isa which has included activation of the new K57 shaft, adoption of a new stoping method and increased use of diesel underground haulage, supported by mill and smelter modifications, has raised the daily ore treatment rate from 11,000 to 16,000 tons. Early in 1969 the company announced plans to develop the new Northern Leases orebody, 12 miles north of Mount Isa. The proposed new facility, scheduled for completion in 1976, will cost over $100 million and will more than double the firm's current output of lead, zinc, and silver. During 1968 work on the McArthur River prospect in Northern Territory has consisted principally of research to develop a solution to the metallurgical problem.

Refining facilities that will raise the production capacity of standard and high-grade refined zinc were being added at the Sulphide Corporation Cockle Creek Smelter.

Domestic consumption of lead in 1967 totaled 66,653 tons of which 23,877 was from secondary materials. Zinc consumption, all primary, totaled 104,183 tons.

Manganese Ore.—Production of manganese ore from the Broken Hill Pty. Co. Ltd. mines on Groote Eylandt in the Gulf of Carpentaria and the Bell Brothers Pty. Ltd. mines and other producers in Western Australia totaled nearly 750,000 tons in 1968. Most of the Western Australia output and half of that from Groote Eylandt went to make up Australia's record annual exports of 434,400 tons. During the first 9 months of the year, 61 percent of the exported ore went to Japan and 39 percent to the United States and West European countries.

Late in 1968 BHP announced a $21 million expansion program that is expected to raise production capacity at Groote Eylandt from the present 400,000-ton annual level to 700,000 by mid-1971 and to 1 million tons by 1974. Also to be undertaken are research into agglomeration of fine concentrates and feasibility studies aimed at establishing ferromanganese production facilities in the Northern Territory. In 1967 apparent consumption of metallurgical grade manganese ore was 244,000 tons. Most of the domestic requirements were supplied from Groote Eylandt. The declining need for imports is evident in the drop from over 63,000 tons in 1965 to 6,656 tons in 1967.

Nickel.—Following startup in June 1967, and near capacity production through the yearend, the Western Mining Corporation (WMC) mine at Kambalda, Western Australia, firmly initiated Australia as a nickel producer with a full year's output in 1968. The discovery and subsequent success of WMC has generated dynamic search and development activities. In 1968 over 150 companies were engaged in nickel exploration and development in the Kalgoorlie and Pilbara areas of Western Australia, in the Greenvale region in northern Queensland, and at numerous other Australian prospects. Construction has proceeded through 1968 on the WMC nickel refinery (which will employ the Sherritt Gordon ammonia leach process) at Kwinana. A recently announced revision has raised the refinery design capacity from 15,000 to 18,000 tons per year. The WMC mine at Kambalda will supply the refinery when it comes on stream in 1970, and also continue concentrate exports—40,000 tons contained nickel over 10 years—to Sumitomo Metal Mining Co. Ltd. in Japan.

The Scotia mine, in the Kalgoorlie district, being developed by Great Boulder Gold Mines Ltd. and North Kalgoorlie (1912) Ltd. is expected to start production in mid-1969. Reserves of the sulfide orebody are estimated at 1.25 million tons averaging 3.07 percent nickel. Initial operation will be at 120,000 tons ore per year. The companies are considering erection of a nickel matte smelter at Kalgoorlie.

Metals Exploration Pty. Ltd. and Freeport of Australia Inc. are partners in developing a sulfide nickel deposit, estimated to contain 500,000 tons averaging over 4 percent nickel, at Nepean, Western Australia, and in investigating a lateritic nickel prospect with 45 million tons averaging 1.55 percent nickel and 0.11 percent cobalt, at Greenvale in northern Queensland.

Through its subsidiary South Western Mining Ltd., International Nickel Co. of Canada Ltd. continued investigation of the Wingellina lateritic nickel deposit, and the Broken Hill Pty. Co. Ltd.-International Nickel partnership in April 1969 announced

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a new discovery of lateritic ores near Widgiemooltha, also in Western Australia. The prospecting group of Conzinc Riotinto of Australia Ltd., New Broken Hill Consolidated Ltd., and Anaconda Australia Inc., in May 1968 reported a new nickel-copper discovery at Higginsville, 50 miles south of Kalgoorlie, in Western Australia.

Silver.—Virtually all of Australia's silver is coproduced with ores of lead, zinc, and copper. The record mine output reported in 1968, despite reduced production resulting from labor troubles at the Broken Hill mines is largely credited to the continuing expansion at Mount Isa Mines Ltd. According to preliminary estimates, exports of silver in lead bullion and concentrates totaled 11.1 million ounces in 1968, compared with 10.1 million in 1967. Domestic refinery production was 9,426,000 ounces in 1968.

Principal company sources of silver produced in all mine products during 1966 and 1967 were as follows:

Company	Thousand troy ounces	
	1966	1967
North Broken Hill Ltd	3,658	3,897
Broken Hill South Ltd	1,615	1,774
Zinc Corp. Ltd	2,485	2,443
New Broken Hill Consolidated Ltd	2,338	2,190
Mount Isa Mines Ltd	6,122	6,787
Electrolytic Zinc Co. of Australasia Ltd	1,763	1,716

Tin.—Mine production of tin in 1968 was the highest since the peak years immediately preceding World War I. Full-scale production from the hard rock mines of Renison Ltd. and Cleveland Tin N.L. in Tasmania and the completion of expansion programs at several alluvial tin producers were principal contributing factors. According to 1967 data, the tin mining industry included 393 mines, of which 346 employed four or fewer employees. Production was reported from the Northern Territory and all States except South Australia. New South Wales, Tasmania, and Queensland accounted for 85 percent of the total production. The tin smelter-refinery at Alexandria, near Sydney, New South Wales, is Australia's sole producer of refined primary tin. In 1968 its output of about 3,700 long tons established a new record.

Principal producers of tin in concentrates and quantities of contained tin produced in 1966 and 1967 were as follows:

Company	Long tons	
	1966	1967
Aberfoyle Tin Co. N.L	403	422
Ardlethan Tin N.L	621	655
Austral Malay Tin Ltd	188	216
Australian Placer N.L	NA	186
Cooglegong Tin Pty. Ltd	e 149	219
J. A. Johnston & Sons Pty. Ltd	e 104	185
Pilbara Tin Pty. Ltd	e 224	303
Ravenshoe Tin Dredging Ltd	541	568
Renison Ltd	385	720
Storeys Creek Tin Mining Co. N.L	118	161
Tableland Tin Dredging, N.L	e 470	448
Tullabong Tin Syndicate	275	328

e Estimate. NA Not available.

Exploration and development of tin prospects has continued in many areas of Australia. Early in 1969, the discovery of an extensive area of alluvial tin on the north tip of Cape York Peninsula was announced by Consolidated Mining Industries Ltd. Continuing tests, to the time of the announcement had indicated 21 million yards averaging over 13 ounces per yard.

As a member of the International Tin Council the Government of Australia in December 1968 imposed voluntary export controls on tin and tin concentrates. Permissible total exports by six country members to the control agreement was limited to 38,000 tons during the January 1–March 3, 1969, quarterly period.

Despite exports of tin in concentrates totaling 5,333 long tons in 1968, compared with 3,330 in 1967, the industry was confronted with a moderate oversupply in 1968. Domestic consumption of primary tin fell from 4,400 long tons in 1967 to about 3,850 tons in 1968 as a result of reduced requirements for tinplate by the steel industry. The thinner coatings possible by electroplating rather than dipping is given as the cause of this reduction.

Titanium Concentrates.—The beach sands mining industry operated at a record level in 1968, reporting new quantity and value peaks for annual production of each of the three concentrate products.

Production of ilmenite in Western Australia in 1968 approached the 660,000 ton combined capacity of the several west coast producers. New additions at the Capel

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plant of Western Titanium Ltd. were commissioned early in the year and produced at an annual rate of about 230,000 tons during the final quarter. The Westralian Sands Ltd. (formerly Westralian Oil Ltd.) plant at Yoganup has also benefited from increased capacity, and Laporte Titanium (Aust.) Ltd. recently announced plans to raise capacity of its Bunbury plant from 12,000 to 18,000 tons per year. East coast production of ilmenite will be substantially increased by Murphyores Inc. Pty. Ltd. with the commissioning in January 1969 of a 250-ton-per-hour dredge, 20 miles south of Gladstone, Queensland. Upon completion in March of the new dry plant facilities at Barney Point, the Murphyores project is expected to produce about 100,000 tons of ilmenite, 25,000 tons of zircon, and 6,500 tons of rutile annually.

Although rutile and zircon concentrate producers on the New South Wales and Queensland beaches achieved record production in 1968 and expect somewhat higher output in 1969, the companies are exhausting the supply of higher grade materials. In the future, progressively lower grade sands are anticipated, and viability of some operations will depend on price increases.

Domestic consumption of ilmenite by pigment producers amounted to about 71,000 tons in 1967. Rutile consumption, on the basis of domestic sales, mainly for use in coating welding rods, was estimated at 2,200 tons; and consumption of zircon, largely in foundry and ceramics applications, was put at 4,400 tons.

NONMETALS

Phosphate Rock.—Although a small quantity of phosphate rock has been regularly produced in South Australia, virtually all of the requirement for manufacture of superphosphate has been imported. During 1968 imports amounted to 3.5 million tons, of which, according to 1967 trade detail, Nauru and Ocean Islands in the Pacific and Christmas Island in the Indian Ocean supplied 74 percent. Reserves in all these islands are expected to gradually decline to exhaustion within three decades.

As a result of an intense, Government-sponsored search on the Australian continent, several important discoveries have been reported in the past few years. In 1966 Broken Hill South Ltd. discovered a deposit at Duchess in northwestern Queensland, that has subsequently been appraised at 1.1 billion tons averaging 21 to 22 per cent P_2O_5 in shallow beds ranging 29 to 63 feet thick. The same company in 1967 reported discovery of a deposit 21 feet thick containing about 250 million tons of similar grade material at Lady Annie, 150 miles from the Gulf of Carpenteria. Also in 1967, International Minerals & Chemical Corp. (IMC) and Continental Oil Co have both reported discoveries, near the Lady Annie deposit. Reserves of 500 million tons averaging about 16 percent P_2O_5 were suggested by IMC. While all of these prospects are at present regarded as noncommercial, the various companies are conducting beneficiation research and feasibility studies with a view to future development.

Since 1963 when the Commonwealth Government introduced the Phosphate Fertilizer Bounty Act, to encourage its use, sales of superphosphate have increased 50 percent. The bounty, amounting to $6 per ton, is paid for superphosphate produced and sold for use as fertilizer in Australia. Payments under the Act have averaged $28,500 annually since 1965. Manufacturers reported production of 4,241 tons of standard superphosphate (22 percent P_2O_5 equivalent) in 1968, compared with the record 4,639 tons in 1967.

Salt.—During 1967 the Australian salt industry, consisting of 35 operations employing 193 workers, produced over 714,000 tons. About 73 percent of this was from South Australia. Imperial Chemical Industries of Australia and New Zealand Ltd., at Dry Creek, and Broken Hill Pty. Co. Ltd., at Whyalla reported production, respectively, of 333,167 tons and 44,706 tons in 1967. Salt production in other States has been relatively small in recent years; however major developments in Western Australia and Queensland, based on Japanese market prospects, are expected to change the pattern. Six projects with planned production totaling 10 million tons annually by the late 1970's are involved.

Early in 1968 the State Government of Western Australia, apprehensive of oversupply, considered imposing restrictions on some of the new salt development projects in that State. Likely to be restricted are the Exmouth Salt Pty. Ltd. 1.5-million-ton-per-year facility planned on Exmouth Gulf;

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he Comalco Industries Pty. Ltd. project at)ampier and King Bay (aiming at even- ual output of .6 to 1.5 million tons); and he Norseman Gold Mines N.L.-Sumitomo 'hoji Koisha Ltd. project at Lake Lefroy vhich plans production of 500,000 tons innually by 1971.

The companies authorized to proceed will probably include the Shark Bay Salt Pty. Ltd. venture at Shark Bay which started contract shipments to Japan in 1967; the Leslie Salt Co. project at Port Hedland, expected to commence in 1969; and the Texada Mines (Australia) Ltd. salt-potash project at Lake McLeod. Ultimate production of 7 to 8 million tons, and exports of 4 million tons annually by 1975 are anticipated from these salt projects.

Apparent domestic consumption of salt was estimated at 640,000 metric tons in 1967, up 13 percent above the 1966 total.

Sulfur.—Sulfur resources, other than that contained in pyrite and other metallic sulfide ores and an insignificant quantity of elemental sulfur recovered in petroleum refineries are unknown in Australia. Imports of elemental sulfur from Canada, United States, Mexico, and other countries have increased from less than 200,000 tons in 1961 to over 557,000 tons in 1968. The great bulk of imported sulfur and virtually all of the sulfur recovered from indigenous pyrite and sulfide ores is used in manufacturing sulfuric acid. Reflecting reduced requirements by the manufacturers of superphosphate fertilizers, production of sulfuric acid in 1968 was slightly below the record 2-million-ton level of 1967. During 1967, approximately two-thirds of the acid was made from imported elemental sulfur, 14 percent was derived from domestic pyrite concentrates, 15 percent from zinc concentrates, and the remainder from lead concentrates and other materials. Sources of the 256,800 tons of pyrite concentrates produced in 1967 were mines at Nairne, South Australia, and Norseman, Western Australia. Use is also made of the sulfur byproducts of base metal operations at Mount Morgan, Queensland, and Mount Lyell, Tasmania, and gold mines in Western Australia. Zinc and lead concentrates are the basis of sulfuric acid produced at the smelters at Risdon, Tasmania, and Cockle Creek, New South Wales.

Early in 1968 a new company, Central Queensland Acid Pty. Ltd., started construction of a sulfuric acid plant at Gladstone, Queensland, which will use Mount Morgan Ltd. pyrite concentrates to produce 1,000 tons of acid per day. The plant is scheduled to start operation in 1970. Late in the year EZ Industries Ltd. and The Mount Lyell Mining and Railway Co. Ltd. organized North-West Acid Pty. Ltd. to build and operate another new acid plant at Burnie, Tasmania. According to plans, this plant will produce 420,000 tons of sulfuric acid a year from 300,000 tons of pyrite concentrates that will be supplied equally from mines of the two principals. It is also expected to begin production in 1970.

Government subsidy payments to the industry under the Pyrites Bounty Act[6] and Sulfuric Acid Bounty Act totaled $1.43 million in 1968, compared with $1.55 million in 1967 and $1.57 million in 1966.

MINERAL FUELS

Black Coal.[7]—In 1968 new national records were established for both production and exports of black coal. Production at about 41 million tons was 16 percent greater than in 1967, and the quantity exported, estimated at 12.5 million tons, was up about 35 percent. Although six of Australia's States contribute, the great bulk of black coal production has traditionally been from underground mines in New South Wales. In 1968 New South Wales output amounted to 30.7 million tons, of which 9 million tons were exported. Queensland, the second largest producer State, accounted for nearly 7 million tons output and 3.4 million tons exported.

The recent surge in coal mining reflects the growing Japanese industrial demand that has been confirmed by long-term contracts. According to estimates by the Japanese Ministry of Trade and Industry, Australia is scheduled to furnish 39 percent of Japan's import requirements totaling 31.3 million tons in the April 1968–March 1969 fiscal year. The United States is expected to supply 37 percent and the U.S.S.R., Canada, and other countries, the remainder.

[6] Amount of bounty paid to pyrites producers is geared to price of imported sulfur. Pyrites bounty payments have not been made since mid-1966.

[7] Includes bituminous, semianthracite, and subbituminous varieties.

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In 1967, the most recent year for which details are available, Australia's black coal industry included 136 underground mines with 14,385 employees and 14 opencut mines employing 1,063 workers. Approximately 15.7 percent of the year's total production was from opencut mines. The Joint Coal Board [8] reported productivity in leading producer States as follows:

Table 5.—Black coal production per man-shift

(Metric tons, on the basis of all employees)

State	Underground mines			Opencut mines		
	1965	1966	1967	1965	1966	1967
New South Wales	8.5	8.8	9.1	20.8	21.4	19.2
Queensland	5.5	6.0	6.2	17.6	18.3	15.8
South Australia	---	---	---	27.5	28.8	30.8
Western Australia	4.3	4.4	4.6	11.4	12.0	13.0
National total	7.8	8.2	8.5	20.2	20.7	19.5

Major developments in the black coal mining industry during 1968 were in Queensland. The Moura-Gladstone railroad was officially opened in January and shipments from the Thiess Peabody-Mitsui Pty. Ltd. opencut mines continued throughout the year. Utah Development Co. announced an 8-million-ton increase in their contracts, bringing total commitment for Blackwater Mine Coal to 21.5 million tons. In a joint project, Utah Development Co. and the Mitsubishi Shoji group negotiated with the Queensland Government for development of the Groonyella coalfield, north of Blackwater. The plan involves exploitation of over 2 billion tons of high-quality coking coal in six central Queensland areas: Groonyella, Saraja, Peak Downs Highway, Barwon, Norwich, and German Creek. Investment of $100 million is anticipated for development of mines, a 140-mile railroad, townsites, and a port facility at Point Hay. A marketing contract, signed early in 1969 with 14 Japanese companies, calls for 85 million tons of coking coal to be delivered over a period of 13 years beginning in 1971.

Australian domestic consumption of black coal in recent years was distributed as follows:

Industry	Thousand metric tons		
	1965–66	1966–67	1967–68
Iron and steel	6,210	6,782	7,245
Electricity	10,570	10,979	11,546
Railways	1,036	777	572
Town gas	1,270	1,148	1,096
Cement	943	865	811
Metallurgical coke	450	440	477
Ships bunkers	89	62	14
Other	2,285	2,093	2,282
Total	22,853	23,146	24,043

Brown Coal.—In 1968 production of brown coal from the opencut mines in the Latrobe Valley and other localities within 100 miles of Melbourne, Victoria, was slightly below the 23.76-million-ton peak attained in 1967. According to 1967 data, all recorded production was by four operators. However, the three mines (Yallourn, Morewell, and Yallourn North) operated by the State Electricity Commission accounted for 98 percent of the total. The Maddingly Brown Coal Pty. Ltd. (subsidiary of Australian Paper Manufacturers Ltd.), opencut mine at Bacchus Marsh was the largest privately owned operation.

Since brown coal cannot be economically transported, virtually the entire mine production is consumed locally. The use pattern in recent years has approximated 75 percent in generation of electric power, 23 percent in manufacture of briquets, and 2 percent has been used as industrial fuel.

Manufacture of brown coal briquets by the State-owned Yallourn and Morewell briquet works in 1968 totaled 1,577,000 tons (1,874,000 in 1967).

Petroleum and Natural Gas.—During 1968 the Australian oil and gas industry continued intensive exploration and preparation of new fields for commercial production. According to early estimates the year's output of crude petroleum was up 80 percent and natural gas production was more than 40 percent above the 1967 figures. While the quantities are unimpressive by world standards, in the light of

[8] Joint Coal Board. Twenty-First Annual Report 1967–68. Sydney, Australia, 1968, p. 236.

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Australia's virtually complete paucity in these commodities prior to 1964, the year's gains and the potential of recent discoveries of oil and gas are of considerable significance to the energy sector of the national economy. From an apparent self-sufficiency of 1.3 percent estimated by the Bureau of Mineral Resources in 1964, the ratio has risen to 10 percent in 1968. Proved reserves in the Bass Strait, between Victoria and Tasmania; in the Barrow Island field, off Western Australia, and the Moonie-Alton field in central Queensland, justify expectations that domestic production will supply 60 to 70 percent of Australia's crude oil needs by 1971.

Exploration activities in 1967 and 1968 have been conducted in all States, the Northern Territory, and Papua and New Guinea. Private companies, the Bureau of Mineral Resources and State Geological agencies have participated in these programs. Expenditure on petroleum exploration and development in 1967 totaled $116.5 million. Private industry's contribution amounted to $99.3 million and the various governments added to $17.2 million. Commonwealth Government payments under the Petroleum Search Subsidy Act were $11.55 million in 1967 and a record high of $15.5 million in 1968.

Culminating several years of study, the Commonwealth and State Governments enacted legislation, in November 1967, to administer petroleum exploration and production in the offshore areas of Australia and the island Territories of Papua and New Guinea. The several Acts became effective April 1, 1968. They are identical and interlocking and provide for joint Federal and State jurisdiction through exploration, development and production, including well-to-shore pipeline construction and operation.

Exclusive of wells drilling or suspended at December 31, drilling during 1968 totaled 1,106,804 feet in 226 completed holes. The 90 exploratory wells accounted for 645,941 feet and development drilling in 136 wells totaled 460,863 feet. Areas of principal drilling activity were Western Australia—433,834 feet, Queensland—253,962 feet, and Victoria—179,359 feet. Approximately 28 percent of the footage drilled was offshore, largely development drilling by Esso-BHP [9] on the Gippsland Shelf, off the Victoria coast.

Onshore discoveries were reported during the year in the Grafton Range, Queensland (gas); at Mondara and Wicher Range (gas), and Flarcourt (oil) in Western Australia; and Daralingie (gas and oil) and Todachee (gas) in South Australia. Offshore new discoveries were made in the Barracouta field (deep oil), and in the Flounder, Snapper, and Tuna (all oil and gas) fields, in Bass Strait; at Legendre, Dampier and Gage Roads (all oil) off Western Australia; and at Urma and Pasca (oil and gas) in Papua.

Australian proved and probable reserves of crude oil at yearend 1968, were estimated at 1.715 billion barrels. Natural gas reserves were put at 9.5 trillion cubic feet.

Australia's 11 refineries produced 151.1 million barrels of marketable products in 1968, an increase of nearly 10 percent above 1967 levels. Feedstock to the refineries amounted to 163.6 million barrels, of which 13.6 million barrels was from domestic sources, and 150 million imported from Indonesia, Kuwait, Saudi Arabia, and other countries. With the completion of expansion at the Shell Refinery at Geelong, near Melbourne, Victoria, in 1968 Australia's refinery annual capacity has been raised to 222 million barrels. Domestic consumption of refined products during the year was 149 million barrels. Foreign trade in these items included imports totaling 7.2 million barrels and exports totaling 8.2 million barrels.

[9] Esso Exploration and Production Australia Inc. and Hematite Petroleum Pty. Ltd. (subsidiary of The Broken Hill Proprietary Co. Ltd.)

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The Mineral Industry of Austria

By Roman V. Sondermayer[1]

During 1968 Austria's mineral industry reflected the general improvement in the national economy and output of most principal mineral commodities showed increases when compared with 1967 totals. However, Austria contributed only modest quantities of minerals and related products to the world economy, and its mineral production was largely of domestic importance. Aluminum, copper, lead and zinc, steel, cement, magnesite, crude oil, and natural gas remained the principal mineral commodities produced in the country.

Except for magnesite and some other less significant nonmetals, the mineral industry of Austria depended on imports to satisfy demand. Austria's mineral economy contributed slightly over 2 percent to the gross national product (GNP) and employed about 22,000 persons. The value of crude mineral production by major segments of the industry in million dollars was as follows:

Commodity group	1964	1965	1966	1967 r	1968
Petroleum and natural gas [1]	$83.4	$87.6	$85.6	$91.2	$84.4
Stone and industrial minerals	69.1	82.0	76.4	73.2	71.6
Coal	44.4	40.1	37.5	34.2	31.6
Metallic ores	35.2	35.0	35.3	37.4	27.8
Salt and brine	7.0	7.6	7.6	8.4	8.1
Total	239.1	252.3	242.4	244.3	223.5

r Revised. [1] Includes oil shale.

There were no new plant additions of significance to Austria's mineral industry nor were any important mineral discoveries reported during 1968.

The conclusion of a new agreement with the U.S.S.R. for Soviet natural gas deliveries over a period of 23 years was significant, because large quantities of Soviet gas will be sold for the first time in a noncommunist country.

PRODUCTION

The general trend in the production of principal minerals in Austria was slightly upward during 1968. Most gains were accomplished by the modernization of existing facilities and by larger use of mechanization in mining operations.

The steel industry increased output 14.6 percent by installing new oxygen converters. The petroleum industry, both in the production and refining of crude oil, used modern and advanced technological methods. The output of crude oil increased slightly when compared with that of 1967, mostly because of secondary recovery operations. The output of refinery products went up noticeably and refineries operated at full capacity during 1968.

[1] Foreign mineral specialist, Division of International Activities.

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Table 1.—Austria: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Alumina, gross weight	14,850	17,998	22,088	24,000	24,887
Metal:					
Primary	77,697	78,735	78,927	78,745	85,898
Secondary	39,241	31,072	22,224	24,108	24,258
Antimony:					
Mine output, metal content	893	692	660	690	708
Metal (antimony sulfide)	411	380	551	665	722
Cadmium, metal	19	21	21	19	19
Copper:					
Mine output, metal content	1,613	1,576	1,902	1,906	2,112
Metal, refined including secondary	17,524	18,192	18,061	18,276	18,110
Germanium, metal content of concentrates...kilograms	NA	NA	7,500	8,850	7,400
Iron and steel:					
Iron ore and concentrate...thousand tons	3,563	3,536	3,475	3,473	3,473
Pig iron...do	2,204	2,200	2,195	2,140	2,474
Ferroalloys...do	5	4	5	5	5
Steel ingots and castings...do	3,194	3,221	3,193	3,028	3,467
Steel semimanufactures...do	2,305	2,313	2,375	2,226	•2,560
Lead:					
Mine output, metal content of ore	5,924	5,891	5,685	5,638	6,780
Metal including secondary	13,306	12,986	11,862	13,154	13,051
Manganese content of iron ore	68,786	67,456	69,500	67,760	NA
Silver, metal including secondary...troy ounces	78,947	76,519	93,237	125,709	160,753
Tungsten, mine output (W) content	50	93	65	68	•107
Zinc:					
Mine output, metal content of ore	9,763	9,547	10,483	11,160	12,660
Metal, refined electrolytic, including secondary	12,896	13,113	14,201	14,157	15,294
NONMETALS					
Barite	1,261	2,334	2,800	2,456	1,461
Cement, hydraulic...thousand tons	3,769	4,044	4,501	4,548	4,553
Clays:					
Bentonite	3,121	4,037	1,687	960	510
Illite	71,070	68,318	143,315	136,500	172,406
Kaolin	368,119	327,678	377,680	383,779	327,145
Other	48,466	50,898	68,937	46,650	68,988
Diatomite	3,832	4,034	3,754	3,657	2,979
Feldspar	1,629	1,419	1,531	2,480	2,174
Graphite, crude	102,237	85,755	79,539	31,541	25,468
Gypsum and anhydrite, crude...thousand tons	568	618	777	738	698
Lime...do	730	692	694	698	•720
Magnesite:					
Crude...do	1,657	1,816	1,615	1,535	1,547
Sintered or dead burned...do	522	566	491	450	482
Caustic calcined...do	192	198	199	176	175
Pigments (specular hematite)	4,804	5,283	4,780	5,268	9,959
Quartz and quartzite	68,897	76,992	60,660	22,634	18,372
Salt:					
Rock	1,381	985	815	899	963
Evaporated	166,802	185,599	185,000	190,973	200,808
In brine •...thousand tons	224	217	284	283	240
Stone, n.e.s.:					
Building...thousand tons	NA	NA	47	949	55
Crushed...do	7,086	6,884	7,112	7,398	NA
Sand and gravel, n.e.s...do	NA	NA	4,750	4,474	5,280
Sulfur, elemental recovered	29,500	30,200	29,275	31,550	31,875
Talc and soapstone	71,875	75,902	76,308	77,733	84,554
Trass	22,882	20,426	21,081	22,684	18,372
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous...thousand tons	103	59	20	14	------
Lignite...do	5,761	5,450	5,283	4,604	4,192
Coke, all types...do	1,921	1,834	1,697	1,620	1,718
Gas:					
Manufactured, all types, million cubic meters	877	864	821	774	•780
Natural gas...do	62,289	60,872	66,163	60,386	•57,562
Petroleum:					
Oil shale...thousand tons	45	580	320	598	400
Crude oil, from wells...do	2,663	2,855	2,757	2,685	2,724
Refinery products:					
Gasoline, all kinds...do	514	644	701	838	850
Kerosine and jet fuels...do	69	51	93	78	90
Distillate fuel oils...do	859	851	861	895	1,019
Residual fuel oils...do	1,591	1,793	1,849	2,028	2,279
Liquefied petroleum gases...do	67	81	77	85	89
Lubricants, all kinds...do	192	185	206	184	253
Asphalt and bitumen...do	159	187	215	244	240
Other products...do	4	5	4	r3	8
Total...do	3,455	3,797	4,006	r4,355	4,828
Refinery fuel...do	70	81	95	98	63
Refinery losses...do	129	69	77	76	82

• Estimate. r Revised.

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TRADE

The value of Austria's mineral trade followed a decreasing trend in 1967, the most recent year for which complete data are available. Mineral commodities accounted for a slightly lesser share of Austria's total commodity trade than in 1966 as shown in the following tabulation:

Products of the iron and steel industry accounted for 64.3 of exports, and mineral fuels, both liquid and solid, were 38.3 percent of total Austrian imports of minerals commodities in 1967. West Germany was Austria's largest trading partner in minerals during 1967.

	Value (million dollars)		Mineral commodities share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1966	350.9	1,683.3	20.8
1967	352.0	1,808.8	19.4
Imports:			
1966	449.3	2,327.6	19.3
1967	396.4	2,309.5	17.1
Trade balance:			
1966	−98.4	−644.3	XX
1967	−44.7	−500.7	XX

XX Not applicable.

Table 2.—Austria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Oxide and hydroxide	17,557	-------	
Metal, including alloys:			
Scrap	5,452	5,899	Italy 2,964; West Germany 2,898.
Unwrought	37,084	23,593	West Germany 17,865; Switzerland 1,934.
Semimanufactures	22,985	24,210	West Germany 6,852; United Kingdom 2,997; Sweden 2,248.
Antimony:			
Ore and concentrate	389	-------	
Sulfide	12	2	All to Hungary.
Cadmium metal, including alloys, all forms. kilograms	4,600	700	All to West Germany.
Chromite	494	516	West Germany 296; Italy 201.
Copper metal, including alloys:			
Unwrought, including scrap	5,103	4,541	West Germany 3,715; Switzerland 487.
Semimanufactures	8,175	7,354	Sweden 1,232; Bulgaria 1,169; Switzerland 798.
Gold and gold alloys troy ounces	8,070	18,358	West Germany 14,854; Italy 1,998.
Iron and steel:			
Iron ore and roasted pyrites	122	395	Belgium-Luxembourg 375.
Ashes and residues thousand tons	116	97	All to West Germany.
Scrap do	6	12	Italy 6; Switzerland 3; West Germany 2.
Pig iron and ferroalloys do	5	14	Italy 9; West Germany 2.
Steel ingots and other primary forms thousand tons	400	362	West Germany 322.
Semimanufactures:			
Iron and steel shapes do	191	189	Italy 28; West Germany 24; Switzerland 23; Hungary 20.
Plates and sheets do	472	514	U.S.S.R. 108; West Germany 78.
Hoop and strip do	61	68	Switzerland 32; Bulgaria 9.
Other do	114	112	Switzerland 25; West Germany 13; Hungary 11.
Lead:			
Oxides	1,546	1,331	Czechoslovakia 1,055; Yugoslavia 276.
Metal, including alloys, all forms	1,997	2,733	Italy 2,574.
Magnesium metal, including alloys, all forms.	336	320	West Germany 132; United Kingdom 77.

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Table 2.—Austria: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Manganese oxide	363	351	Brazil 144; West Germany 120; Denmark 64.
Mercury—76 pound flasks	293	328	France 104; West Germany 84; Netherlands 32.
Molybdenum metal, including alloys, all forms.	281	363	West Germany 202; Hungary 84; United Kingdom 53.
Nickel metal, including alloys, all forms	208	142	West Germany 119; Netherlands 15.
Platinum group metals, troy ounces, including alloys, all forms.	6,302	6,302	West Germany 3,569; Rumania 1,608; Italy 675.
Rare earth metals and compounds n.e.s	265	221	NA.
Silver metal, including alloys:			
Bullion—thousand troy ounces	145	141	All to West Germany.
Semimanufactures—do	35	98	Yugoslavia 39; West Germany 28; Rumania 19.
Tantalum metal, including alloys, all forms. kilograms	4,000	2,700	West Germany 1,500; United Kingdom 500; Poland 300; France 300.
Tin:			
Oxide—long tons	137	78	Czechoslovakia 54; Poland 17; Portugal 7.
Metal, including alloys, all forms. long tons	26	17	West Germany 9; Denmark 6; Yugoslavia 2.
Tungsten:			
Ore and concentrate	101	164	All to West Germany.
Metal, including alloys, all forms	119		
Zinc:			
Ore and concentrate	-------	-------	
Metal, including alloys, all forms	3,892	6,720	Italy 5,022; Switzerland 1,077.
Other:			
Nonferrous ores, n.e.s	93	129	West Germany 62; Belgium-Luxembourg 35.
Ashes and slag, n.e.s	14,289	17,081	Italy 8,820; West Germany 3,828; Yugoslavia 3,529.
Salts and compound of unspecified rare-earth elements.	254	573	West Germany 556.
NONMETALS			
Asbestos:			
Crude	1,701	13	Rumania 5; Italy 4; Switzerland 4.
Cement and cement products	11,007	9,062	West Germany 6,016.
Barite and witherite	-------	61	Yugoslavia 60.
Cement, hydraulic	15,096	9,487	West Germany 8,518.
Chalk	3,244		
Clay:			
China clay	31,487	27,813	Italy 18,456; Switzerland 6,037.
Other clays and crude refractories	1,148	1,888	United Kingdom 842; Switzerland 647.
Cryolite and chiolite, natural	4	4	All to Mexico.
Diatomite and other siliceous earths	257	248	Bulgaria 120; Yugoslavia 64.
Diamonds and other gem stones:			
Uncut—thousand carats	165	-------	
Other—do	350	390	United States 194; Switzerland 103; United Kingdom 82.
Feldspar	2,165	386	Italy 227; West Germany 91; Switzerland 42.
Fluorspar	-------	20	All to France.
Graphite, natural	16,876	18,210	Italy 10,416; West Germany 5,211.
Gypsum and plasters	79,728	-------	
Lime, hydraulic and slaked	2,128		
Magnesite:			
Crude	412	386	West Germany 304; Switzerland 77.
Sintered	228,969	188,310	West Germany 102,759; United States 24,735.
Caustic calcined	91,530	79,628	West Germany 59,040.
Bricks and plates	136,749	134,801	West Germany 21,413; France 20,898 Sweden 19,761.
Other products, not burnt, including chrome-magnesite products.	97,011	82,070	West Germany 22,667; France 15,988; Rumania 13,946.
Mica and mica products	25	2	Netherlands 1.
Pigments, mineral	2,697	3,406	West Germany 1,490; United Kingdom 961.
Refractories n.e.s	3,845	149,557	West Germany 25,756; France 24,162; Sweden 20,406.
Salt brine	-------	4	NA.

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Table 2.—Austria: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Stone, sand, and gravel:			
Dimension stone:			
Crude and partly worked	177,286	154,495	West Germany 134,054; Switzerland 19,886.
Worked:			
Slate	61	51	West Germany 46.
Other	9,720	12,112	West Germany 6,292; Switzerland 5,629.
Dolomite	38,748	31,670	West Germany 24,515; United Kingdom 3,179.
Gravel and crushed rock	125,286	258,688	West Germany 209,961; Switzerland 47,500.
Limestone	882,745	840,986	All to West Germany.
Quartz and quartzite	153	270	Netherlands 148; West Germany 98.
Sand, excluding metal bearing	43,221	56,440	West Germany 45,299; Switzerland 9,086.
Talc and soapstone	60,558	61,748	West Germany 28,621; Italy 9,494.
Vermiculite and mineral wool	80,568	45,526	West Germany 4,351; Italy 1,047.
Nonmetals n.e.s.:			
Ceramic scrap	329	128	West Germany 102; Italy 19.
Other	813	8,006	West Germany 1,828; Hungary 1,801.
MINERAL FUELS AND RELATED MATERIALS			
Lignite and briquets	9,428	15,366	West Germany 15,076.
Coke	10,621	48,280	Yugoslavia 24,130; Rumania 24,121.
Gas, manufactured	7	-------	
Petroleum refinery products:			
Distillate fuel oil	24,956	8,109	West Germany 7,906.
Lubricants	71,023	79,353	Czechoslovakia 33,666; Poland 28,256.
Other	8,303	15,649	Poland 10,168.
Crude chemicals from the distillation of coal and natural gas.	2,784	4,874	West Germany 2,404; Italy 1,297.

Table 3.—Austria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	24,580	30,948	Surinam 21,902.
Alumina, including hydroxide	160,034	174,845	NA.
Metal, including alloys:			
Unwrought, including scrap	4,479	5,340	U.S.S.R. 2,307; East Germany 912; Yugoslavia 870.
Semimanufactures	7,806	7,262	West Germany 2,695; Switzerland 2,159; Italy 1,072.
Antimony metal, including alloys, all forms	115	128	Belgium-Luxembourg 88; United Kingdom 20; Czechoslovakia 15.
Arsenic trioxide, pentoxide, and acids	47	21	All from West Germany.
Beryllium metal, including alloys, all forms. kilograms	300	200	West Germany 100; United States 100.
Cadmium metal, including alloys, all forms	8	9	West Germany 7; Netherlands 1; Belgium-Luxembourg 1.
Chromium:			
Chromite	48,069	36,989	Turkey 16,295; Iran 15,121.
Oxides and hydroxide	160	108	West Germany 90.
Copper:			
Ore and concentrate	738	2,920	Czechoslovakia 1,918; West Germany 1,002.
Metal, including alloys:			
Scrap	5,448	4,828	West Germany 3,170; Switzerland 1,111.
Unwrought	19,952	20,774	West Germany 11,698; Republic of South Africa 3,501.
Semimanufactures	5,132	5,348	West Germany 2,712; United Kingdom 823; Switzerland 575.
Gold and gold alloys. thousand troy ounces	1,164	1,621	United Kingdom 1,291.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Iron and steel:			
Ore and concentrate..thousand tons..	1,175	904	Brazil 330; U.S.S.R. 288; West Germany 285.
Roasted pyrite.....do.....	346	335	Italy 321.
Metal:			
Scrap.....do.....	55	18	East Germany 6; West Germany 2; Yugoslavia 1.
Pig iron, including cast iron.[1] thousand tons..	159	101	U.S.S.R. 39; Hungary 20; East Germany 11.
Ferroalloys:			
Ferromanganese.....do.....	12	11	Norway 6; Czechoslovakia 1; West Germany 1.
Other.....do.....	35	30	Norway 4; U.S.S.R. 4; Czechoslovakia 3; Yugoslavia 3.
Steel ingots and other primary forms. thousand tons..	52	98	Bulgaria 28; Rumania 26; Hungary 20; Poland 15.
Semimanufactures.....do.....	261	216	West Germany 113; Belgium-Luxembourg 24.
Lead:			
Ore and concentrate.....	2,600	3,100	All from Italy.
Oxides.....	91	181	United Kingdom 131; West Germany 25.
Metal, including alloys:			
Unwrought, including scrap.....	14,021	13,964	Yugoslavia 10,596; Bulgaria 2,478.
Semimanufactures.....	129	358	NA.
Magnesium metal, including alloys, all forms.	508	539	Italy 323; U.S.S.R. 99; West Germany 94.
Manganese:			
Ore and concentrate.....	1,306	589	Netherlands 374; West Germany 115; mainland China 60.
Oxides.....	160	174	Japan 150; Belgium-Luxembourg 19.
Mercury.....76-pound flasks..	583	325	France 70; Netherlands 67; West Germany 61.
Molybdenum:			
Oxides.....	537	337	West Germany 286; United States 51.
Metal, including alloys, all forms.....	7	8	United States 5.
Nickel:			
Matte, speiss, and similar materials....	737	711	United Kingdom 496; Hungary 100; Canada 77.
Metal, including alloys:			
Unwrought, including scrap.....	2,364	1,892	United Kingdom 1,115; France 242; U.S.S.R. 208.
Semimanufactures.....	568	524	West Germany 236; United Kingdom 172.
Platinum-group metals, including alloys, all forms. troy ounces..	5,691	5,916	West Germany, 3,729; Switzerland 1,190.
Silver metal, including alloys:			
Bullion.....thousand troy ounces..	3,778	3,278	United Kingdom 1,174; United States 1,058; West Germany 547.
Semimanufactures.....do.....	177	215	West Germany 103; Switzerland 97.
Tantalum metal, including alloys, all forms. kilograms..	5,700	4,000	United States 1,900; West Germany 1,100; Switzerland 1,000.
Tin metal, including alloys:			
Unwrought, including scrap. long tons..	565	528	Netherlands 293; Italy 59.
Semimanufactures.....do.....	41	83	West Germany 30; Switzerland 19; United Kingdom 10; Netherlands 10.
Titanium oxide.....	5,235	5,766	West Germany 3,562; United Kingdom 1,054.
Tungsten:			
Ore and concentrate.....	3,550	2,658	Mainland China 1,663; Australia 555; South Korea 391.
Oxide and hydroxide.....	223	214	West Germany 135; France 80.
Metal, including alloys, all forms.....	25	71	West Germany 23; United States 16; France 11.
Salts and compounds of uranium, thorium and rare-earth elements.	83	777	Brazil 699.
Zinc:			
Ore and concentrate.....	12,450	13,248	All from Italy.
Oxide (zinc white).....	485	526	West Germany 435.
Metal, including alloys:			
Unwrought.....	7,297	5,576	Bulgaria 1,495; Poland 1,409; Yugoslavia 1,099; West Germany 975.
Semimanufactures.....	736	686	Yugoslavia 372; West Germany 114; United Kingdom 104.

See footnote at end of table.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Other:			
Ore and concentrate	5,661	4,552	Turkey 1,629; Iran 1,512; Cyprus 543.
Ash and residues containing nonferrous metals.	11,964	24,770	East Germany 9,097; Poland 8,141; West Germany 3,011.
Other ashes and slags n.e.s	730	1,298	West Germany 907; Switzerland 362.
NONMETALS			
Abrasives:			
Natural:			
Dust and powder from gem stones. thousand carats	40	6,130	Belgium-Luxembourg 6,060.
Pumice	734	317	Italy 172; West Germany 145.
Emery, corundum and other	123	66	Greece 46; Netherlands 10; West Germany 9.
Artificial corundum	4,136	3,637	West Germany 2,544; France 757.
Asbestos:			
Crude	34,169	17,475	Canada 8,798; Republic of South Africa 3,451; Cyprus 1,762.
Cement and cement products	13,106	10,061	West Germany 8,759.
Other products excluding friction material.	588	434	West Germany 258; Yugoslavia 68.
Barite and witherite	5,954	7,334	West Germany 3,171; Yugoslavia 2,642; Rumania 751; Italy 750.
Boron salts, natural	5,789	8,146	United States 6,980; Turkey 1,137.
Cement, hydraulic	27,186	19,622	France 5,219; West Germany 4,659; Italy 4,404.
Chalk	971	775	France 467; East Germany 167; West Germany 137.
Clays and clay products:			
Clays and refractories, crude	118,474	104,243	West Germany 44,976; Czechoslovakia 37,802; United Kingdom 13,149.
Bricks, tubes and pipes, nonrefractory	126,132	119,770	Italy 52,425; West Germany 37,000.
Cryolite and chiolite, natural	421	357	Denmark 357.
Diatomite and other siliceous earth	2,765	2,355	United States 983; West Germany 977.
Dolomite, crude and sintered	3,295	2,201	Italy 1,885; West Germany 310.
Gem stones, including industrial diamonds:			
Uncut thousand carats	56,335	58,890	United States 16,400; Canada 11,680; Brazil 10,550; West Germany 8,470.
Other gem stones, crude or cut but not mounted. thousand carats	2,625	4,020	West Germany 1,975; India 1,400.
Industrial diamonds do	35	205	India 30; West Germany 5.
Graphite:			
Natural	234	298	West Germany 141; South Korea 100; France 40.
Refractories	263		
Gypsum and anhydrite, crude and sintered	19,478	27,508	Poland 20,330; West Germany 2,989.
Lime, hydraulic and slaked	690	496	West Germany 491.
Limestone, industrial	444	13	NA.
Magnesite:			
Crude	32,314	3,988	Turkey 3,781.
Sintered and caustic calcined	23,417	23,786	Turkey 14,982; Greece 8,567.
Magnesite and chrome-magnesite products, unfired.	1,824	1,667	Italy 1,585.
Mica:			
Crude and scrap	382	237	Norway 103; West Germany 71; United Kingdom 44.
Manufactures	27	32	Switzerland 22.
Pigments, mineral	283	202	France 158; West Germany 25.
Phosphates:			
Phosphate rock:			
Crude	223,583	191,075	United States 125,772; Morocco 53,639.
Ground	41,142	83,642	West Germany 47,211; U.S.S.R. 34,361.
Thomas slag	325,880	305,661	France 161,899; Belgium-Luxembourg Luxembourg 115,656.
Other	6,218	1,294	Netherlands 879; France 265.
Potash:			
Crude salts	123,889	91,037	All from East Germany.
Potassium chloride	136,289	168,506	East Germany 52,174; France 45,140; West Germany 39,242; U.S.S.R. 31,948.
Potassium sulfate	17,766	26,278	West Germany 16,154; East Germany 5,299; Italy 4,825.
Potassium-magnesium sulfate	32,575	32,329	All fron West Germany.
Other potash fertilizers	2,517	10	NA.
Pyrites, unroasted	26,465	24,912	U.S.S.R. 15,403.
Quartz and quartzite	15,087	15,320	West Germany 13,435; Yugoslavia 1,510.
Refractory building materials	14,261	12,619	West Germany 10,939.
Salt, including brine salt	779	22	West Germany 15; France 5.

See footnote at end of table.

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Table 3.—Austria: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Sand, excluding metal-bearing	141,480	145,508	West Germany 113,329.
Slate:			
Crude or rough cut	571	607	West Germany 202; Italy 148; East Germany 100; Norway 76.
Slate products	257	289	Italy 250.
Stone:			
Dimension, except slate	31,175	36,598	Italy 22,486; Republic of South Africa 3,858.
Crushed stone and gravel	158,771	100,849	West Germany 72,114; Italy 23,829.
Sulfur:			
Elemental thousand tons	82	88	France 14; Poland 11; West Germany 8.
Sublimed	154	1,122	United States 975; West Germany 105.
Sulfuric acid	4,565	6,103	NA.
Talc and soapstone	1,493	1,223	Italy 525; Norway 408.
Trass	1,854	2,029	All from West Germany.
Vermiculite and mineral wool	19,671	15,899	Switzerland 10,704; Italy 2,840; West Germany 1,779.
Other nonmetals, n.e.s.:			
Ceramic scrap	7,080	5,034	West Germany 3,032; Czechoslovakia 1,675.
Other	21,255	19,988	West Germany 17,593.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,333	1,091	United States 493; Trinidad and Tobago 463.
Coal and briquets:			
Bituminous and anthracite thousand tons	3,405	3,165	Poland 1,316; West Germany 745; U.S.S.R. 684; Czechoslovakia 354.
Subbituminous and lignite do	538	574	East Germany 321; West Germany 210.
Coke and coke breeze do	990	967	West Germany 387; Czechoslovakia 279.
Gas:			
Natural, including LPG	2,854	978	Yugoslavia 725; West Germany 154.
Manufactured	1,351	1,454	West Germany 1,451.
Peat thousand tons	15	21	West Germany 10; Poland 7.
Petroleum:			
Crude and tapped crudes do	1,276	1,091	U.S.S.R. 700; Yugoslavia 321.
Refinery products:			
Gasoline do	602	588	Italy 293; Czechoslovakia 99; Hungary 82.
Kerosine do	8	7	Italy 5.
Distillate fuels do	112	115	Italy 106.
Residual fuel oils do	1,216	1,228	West Germany 299; Hungary 214; Italy 177; Czechoslovakia 171.
Lubricants do	57	57	Italy 17; West Germany 16; Netherlands 12.
Mineral jelly and wax	8	8	West Germany 4; East Germany 1.
Other products of coal, oil shale, bitumen, and asphalt thousand tons	435	327	Hungary 108; Italy 79; West Germany 76.

[1] Includes spiegeleisen, shot, powder, and sponge.

COMMODITY REVIEW

METALS

Copper.—During 1968 Austria remained a modest producer of copper ore, concentrate, and electrolytic copper. The output of 18,110 tons of electrolytic copper was only 1 percent lower than in 1967. The upward trend in copper ore production continued chiefly because of favorable conditions in the world copper market. Prevailing copper prices made production from marginal Austrian copper ores attractive.

Two copper mines, one near Salzburg and one in Tirol, produced about 180,000 tons of copper ore and employed about 400 persons.

Smelting and refining of the country's entire output of copper ore was performed in a single smelter at Brixlegg. Employment in smelting operations reached almost 250 persons in 1968.

The country's principal copper mining company, Kupferbergbau Mitterberger Gesellschaft, and the Republic of South Africa's Union Corp. will jointly explore the old Muehlberg copper deposit where copper has been mined since the Middle Ages. A new joint company may be formed to exploit any reserves that are discovered.

Iron and Steel.—The iron and steel industry remained one of the most important

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segments of Austria's mineral economy in 1968. Iron ore, pig iron, several types of high-quality steel, and steel semimanufactures were the principal items produced.

As in the past, the supply of domestic iron ore was not adequate to meet the demand and imports supplied about one third of requirements in 1968. Mines located in Steiermark, and operated by the Government-owned company Osterreichische Alpine Montangesellschaft A.G. of Vienna, provided about 93 percent of the total output of over 3.4 million tons in 1968.

Opencast mining prevailed in the production of iron ore, with about 60 percent of the output coming from this type of mine. However, the share of open-cast mines in total production declined when compared with output in 1967.

Crude steel output, 3.5 million tons in 1968, exceeded that of the previous year by 14.7 percent. About half the total steel output came from integrated iron and steel plants located at Donawitz and Linz. The tabulation below shows breakdown of Austria's steel production by process and by company:

	Total steel output in 1968 (percent)
Process:	
Oxygen converters	70
Open hearth	26
Electric steel	4
Total	100
Company:	
Vereinigte Oesterreichische Eisen und Stahlwerke A.G	56
Oesterreichische Alpine Montangesellschaft A.G	33
Boehler and Co. A.G	3
Other	8
Total	100

During 1968, investments were aimed at rationalization of production and cost savings. A number of oxygen converters were installed to replace smaller units. A new blast furnace was also commissioned

Other Metals.—Austria also produced small quantities of antimony, lead-zinc, tungsten, and silver during 1968. About 88 percent of the antimony mined was produced in Gangspalte No. 3 Field. There was no antimony smelter in Austria and all concentrates were exported to Belgium for further processing.

There were no significant changes in the lead-zinc mining and smelting industry during 1968 and the production of lead and zinc remained at the same level as in the past.

NONMETALS

Austria produced a variety of nonmetals during 1968. Among the most important were anhydrite, barite, cement, clays, feldspar, graphite, magnesite, quartz and quartzite, salt, talc, and trass. However, only magnesite and graphite were of some significance by world standards. About 80 operations for the production of nonmetallics were active during 1968, and the nonmetallic minerals industry employed about 15 percent of the total labor force working in the country's mineral industry.

Activities in the nonmetallic branch of the industry were of the same order of magnitude in 1968 as in 1967 with a slight overall increase in production. No major developments or changes affecting the nonmetallics industry were reported during the year.

MINERAL FUELS

Austria was a modest producer of low-rank coal, crude oil, and natural gas in 1968. Domestic supplies were not adequate to meet the country's requirements and imports of mineral fuels were necessary to satisfy the demand for energy.

Coal.—The Austrian coal industry had lower production in 1968 than in the previous year. The decline in production reflected the closing down of mining operations, caused mostly by competition from liquid fuels and by the partial exhaustion of minable reserves.

Coal output of 4.2 million tons came from 14 operations with a labor force of about 8,800 persons. Underground mining was predominant; only two open-cast mines were operational in 1968. Three companies, Graz-Köflacher Eisenbahn und-Bergbaugesellschaft in Steiermark, and Salzach-Kohlenbergball G.m.b.H. and Wolfsegg-Traunthaler-Kohlenwerk Aktiengesellschaft in Upper Austria, were the principal coal producers.

Petroleum and Natural Gas.—Austria was a producer of both crude oil and natural gas in 1968. However, domestic

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output was far below the demand and Austria imported both commodities.

Drilling activities for hydrocarbons continued and Austria's drillers completed 59 wells with footage totaling 321,711 feet (about 105,583 meters). Exploration accounted for 14 wells with 115,360 feet; production drilling totaled 14 holes with 56,587 feet; and 25 wells with 135,085 feet were drilled as extensions of existing fields. The deepest well in the country was completed in Matzen, the largest field. Total depth of the well was 19,716 feet, with gas formations at intervals from 15,860 feet to 17,255 feet. Tests showed gas output of about 7 million cubic feet per day.

The Government-owned company, OeMV (Allgemeine Oesterreichische Mineraloelverwaltung Aktiengesellschaft—General Austrian Oil Administration), made an oil discovery on a new concession near Linz. Tests indicated production of 58 barrels per day of crude oil.

OeMV was granted four new concessions near Bad Aussee, Bad Tschl, Sankt. Gilgen and Neukirchen.

The following tabulation indicates the approximate percentage shares of the various Austrian oil companies in the total concession area and in the country's production:

Company	Concession area (percent)	Production	
		Crude oil	Natural gas
Allgemeine Oesterreichische Mineraloelverwaltung Aktiengesellschaft (OeMV)	60	85.2	99
Rohoel-Gewiniungs Aktiengesellschaft (RAG)	28	14.8	1
Vorarlberger Erdoel und Ferngas-Gesellschaft m.b.H (VEFG)	8	------	----
Mesa Petroleum Aktiengesellschaft (MESA)	14	------	----

About 1,200 wells were in production during 1968, of which about 20 percent were flowing, 72 percent were pumping, and 8 percent were producing by gas lift.

Water flooding was used in various oilfields and about 3 million cubic meters of water were injected in various oil formations. Secondary recovery methods accounted for about 10 percent of Austria's total crude oil production.

Total refinery capacity amounted to 97,100 barrels per day in 1968, distributed as follows: OeMV-Schwechat, 88,000 barrels per day; Shell-Austria A.G.-Floridsdorf, 4,600 barrels; Mobil Oil Austria A.G.-Kagran, 4,500 barrels.

During 1968, domestic production of natural gas was about 5 percent lower than in 1967. About 140 gas wells were in production. The decline in natural gas production and small Austrian reserves coupled with rapid increases in demand, make imports of natural gas of paramount significance in supplying energy to the country's economy.

The OeMV concluded an agreement on June 1, 1968, with the U.S.S.R. for Soviet gas deliveries over a period of 23 years. The quantities of gas to be delivered started at 300 million cubic meters in 1968 and will gradually reach 1,000 million cubic meters in 1970. They will continue for the period 1971 to 1990 at a yearly rate of 1,400 to 1,500 million cubic meters.

A connecting link with the Soviet pipeline from the Ukraine to Bratislava, Czechoslovakia, will bring the natural gas to the Austrian border at Baumgarten. The Austrian pipeline system was adapted to the East European network. The short distances between the border and large consumers in Austria lowered the costs of conversion to about 80 million Austrian Schillings ($3.2 million). Storage of gas has become an important concern since large quantities of gas were made available. Tests were made in preparation for the construction of an underground storage-system utilizing depleted gas and oil fields with a total capacity of 150 million cubic meters and providing a peak off take of 2.2 million cubic meters per day. The cost was calculated to be about 170 million Schillings ($6.8 million).

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The Mineral Industry of Belgium and Luxembourg

By Roman V. Sondermayer [1]

During 1968, as in previous years, the mineral industry of Belgium-Luxembourg was primarily devoted to processing imported raw materials, with ferrous and nonferrous metallurgy and petroleum refining the principal activities. Belgium-Luxembourg remained an important supplier of iron and steel, copper, lead, zinc, and refined petroleum products to other European countries. Traditionally Belgium has concentrated on mineral processing with domestic mine output limited to coal and quarry products, while Luxembourg has been primarily a producer of iron ore, iron and steel and, to a lesser extent, construction materials.

BELGIUM

The mineral industry of Belgium was oriented toward processing of imported ores and concentrates, and primary metal forms and the exportation of refined metals. Coal, quarry products, and small quantities of iron ore were the only minerals mined in the country.

The mineral industry production pattern in 1968, as in previous years, showed no clear trend; the output of some commodities moved up from 1967 levels while that of others declined. The output of the coal industry continued to decline in 1968, the result of strong competition from liquid fuels, natural gas, and foreign coal and reduced Government subsidies.

The overall industrial and economic situation improved in 1968. The gross national product (GNP) went up 4.5 percent as compared with the growth of only 3.5 percent in 1967. Data on the minerals industry's share of the total GNP were not available for 1968, but 4 percent can be considered a good estimate. In 1968 the entire minerals industry employed about 130,000 persons.

The only significant changes in the Belgian minerals industry occurred in the iron and steel and petroleum refining industries. Several iron and steel plants were modernized and rationalized and production began at the new 5-million-ton-per-year (100,000-barrel-per-day) Texaco refinery near Ghent.

PRODUCTION

Coal and quarry products were the only minerals mined in the country. The production of coal went down in 1968, as the industry continued the planned closing of mines because high production costs rendered Belgian coal noncompetitive in European Economic Community (EEC) markets. The program for the gradual closing of noneconomic mines was worked out with the EEC in a manner designed to reduce subsidies and avoid social difficulties. Most of the quarry products (clays, stone, sand and gravel) were mined at about the same level of output as in 1967 and the demand for them was adequate.

During 1968 most of the nonferrous metals showed insignificant changes in output levels as compared with figures for previous years. However, steel output rose 19 percent during the year, principally because the new plant at Ghent attained full operating capacity.

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[1] Foreign minerals specialist, Division of International Activities.

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Table 1.—Belgium: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum, metal, secondary only	3,460	3,192	2,545	NA	2,500
Cadmium, (exports)	843	385	146	2	NA
Copper, refined, including secondary	286,129	309,356	303,427	317,873	343,180
Iron and steel:					
Iron ore and concentrate—thousand tons	61	91	124	88	88
Pig iron, including ferroalloys—do	8,122	8,436	8,302	8,902	10,371
Steel:					
Ingots and castings—do	8,731	9,169	8,917	9,716	11,486
Semimanufactures—do	6,475	6,947	6,865	7,511	NA
Lead, metal, including secondary	83,316	110,757	92,659	107,800	95,500
Precious metals, unworked—thousand troy ounces	13,622	14,163	14,499	15,561	NA
Tin, metal, including secondary—long tons	6,804	5,227	r 6,472	r 6,069	5,048
Selenium (exports)	40	42	41	NA	NA
Zinc, metal, including secondary	222,540	239,800	251,700	227,328	254,300
Other nonferrous metals, n.e.s	4,222	4,348	4,608	3,950	4,000
NONMETALS					
Cement, hydraulic—thousand tons	5,846	5,905	5,796	5,820	6,000
Clays—do	203	209	181	167	160
Gypsum, and anhydrite, calcined	91,236	74,919	77,124	73,295	74,000
Lime and dead burned dolomite:					
Quicklime—thousand tons	2,299	2,292	2,232	2,284	2,300
Dead burned dolomite—do	337	r 315	319	304	305
Quartz:					
Quartzite—do	305	305	261	298	300
Glass sand—do	1,332	1,461	1,392	1,530	1,600
Stone, sand and gravel, n.e.s.:					
Limestone and other calcareous—thousand tons	10,909	11,274	12,362	15,039	NA
Marble:					
In blocks—cubic meters	7,272	7,098	7,406	5,090	5,000
Slabbed	11,280	11,540	11,910	8,641	8,700
Crushed and other	32,824	32,974	25,171	33,403	34,000
Petit granite (Belgian bluestone):					
Quarried—cubic meters	409,602	326,826	288,552	286,708	287,000
Sawed—do	104,633	77,483	80,000	75,930	76,000
Worked—do	32,296	18,275	20,974	16,341	17,000
Crushed and other—do	381,971	287,036	261,456	232,903	233,000
Porphrry, all kinds—thousand tons	5,355	5,109	4,185	5,523	5,600
Sand and gravel:					
Construction sand—do	5,171	4,254	4,375	4,467	4,500
Foundry sand—do	1,379	1,266	1,161	1,089	1,100
Other sand—do	2,765	2,771	1,257	1,141	1,200
Gravel (dredged)—do	7,844	6,527	4,361	5,367	5,400
Sandstone:					
Rough stone, including crushed—do	1,547	1,369	1,353	1,445	1,500
Paving and mosaic stone—do	8	17	13	9	9
Other	86	81	77	107	107
Slate, roofing and other	11,750	10,931	10,290	8,607	8,600
Whetstone	49	41	45	37	37
Sulfur:					
Byproduct (recovered)e	5,000	5,000	5,000	5,000	5,000
Sulfuric acid (100 percent)—thousand tons	1,348	1,487	1,362	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—do	6,062	5,438	4,952	4,993	4,321
Bituminous—do	15,242	14,848	12,547	11,442	10,486
Coke, all kinds—do	7,229	7,334	6,961	6,857	7,243
Fuel briquets, all grades—do	1,433	1,074	r 971	868	823
Gas, manufactured, all types—tera calories [1]	NA	34,454	31,666	29,529	NA
Petroleum, refinery products:					
Gasoline:					
Aviation—thousand 42-gallon barrels	53	53	62	71	NA
Motor—do	14,298	17,103	17,657	18,228	21,885
Kerosine—do	1,808	1,708	1,677	2,017	NA
Jet fuel—do	3,590	4,462	5,310	5,203	NA
Distillate fuels—do	31,064	35,511	35,660	35,586	51,063
Residual fuels—do	30,451	37,987	42,116	43,062	47,006
Lubricating oils—do	265	315	279	301	NA
Other—do	9,359	9,966	10,928	12,618	NA
Total—do	90,888	107,105	113,689	117,086	NA
Refinery fuels and losses—do	7,413	7,768	8,551	10,195	NA

e Estimate. r Revised. NA Not available.
[1] One tera calorie =238.095 cubic meters at 4,200 kilocalories per cubic meter.

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TRADE

The foreign trade of Belgium is combined with that of Luxembourg in the official returns of the Belgium-Luxembourg Economic Union (BLEU).

Minerals continued to occupy an important position in Belgium-Luxembourg's total trade in both exports and imports. The tabulation below shows the relationship between the total trade and the trade in mineral commodities for 1966 and 1967, the latest years for which complete data were available:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total trade	
Exports:			
1966	2,610.8	r 6,829.0	38.2
1967	2,659.8	7,032.4	37.8
Imports:			
1966	2,180.5	7,174.0	30.4
1967	2,197.9	7,132.4	30.8
Trade balance:			
1966	+429.8	r −345.0	XX
1967	+461.9	−100.0	XX

r Revised. XX Not applicable.

The largest commodity group among Belgium-Luxembourg's mineral exports were products of the iron and steel industry (of which Luxembourg contributed a significant share) with a reported value of $1,161.9 million. Other mineral exports in the order of their importance were nonferrous metal products ($604.3 million); diamonds, precious stones and gems ($309.4 million); and mineral fuels ($195.2 million).

Among Belgium-Luxembourg's imports, mineral fuels were the largest commodity group, accounting for $615.5 million, of which petroleum refinery products reached $121.6 million.

The member countries of the EEC and the United States were the principal trading partners of Belgium-Luxembourg. Details on trade are shown in tables 2 and 3.

COMMODITY REVIEW

Metals.—*Aluminum.*—During 1968 there was no primary aluminum production in Belgium and the output of secondary aluminum metal was insignificant. Based on imported ingots the production of aluminum semimanufactures amounted to 140,000 tons in 1968. Negotiations between the Kaiser Aluminum & Chemical Corp. and Belgian authorities for the construction of a 110,000-ton-per-year aluminum smelter near Liège were apparently unsuccessful as Alusuisse announced during 1968 construction of an aluminum smelter near Liège with an annual capacity of 66,000 tons per year.

Copper.—Favorable market conditions maintained refined copper production at high levels during 1968 (343,180 tons). As in the past, imports of blister copper provided most of the raw copper consumed in Belgium's refineries during 1968. The Olen plant operated by Société Géneral Métallurgie de Hoboken remained the principal producer of electrolytic copper in the country operating at full capacity during the year. Expansion plans for the Olen plant called for an increase of cathode copper capacity from the present 210,000 tons per year to 260,000 tons in the near future. In addition, a new section for the semicontinuous casting of copper plates and large-diameter billets was under construction. Completion dates for these new facilities were not made public.

Iron and Steel.—As in the past, Belgium's small iron ore production about 90,000 tons in 1968 was insufficient to satisfy demand and its iron and steel industry operated almost entirely on imported ores. Production of steel went up by 18 percent as compared with that of 1967. The sharp increase in steel output was largely due to capacity operation of the new Ghent plant of Siderurgie Maritime S.A. "Sidmar."

Cockerill-Ougrèe-Providence, the largest operating company in Belgium during 1968, continued its rationalization campaign. The primary goal was to increase the degree of specialization in various divisions of the company. At the same time cooperation between Cockerill-Ougree-Providence and Espèrance Longdos was under intensive study and at yearend no definite proposals were made in regard to future cooperation.

The new integrated iron and steel plant at Ghent operated by "Sidmar" was operating close to capacity. In spring 1968 the second blast furnace was blown in, and the plant produced 1.025 million tons of pig iron and 1.221 million tons of steel ingot. The hot rolling mill turned out

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Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite	320	-------	
Metal, including alloys:			
Scrap	8,417	9,897	France 3,838; West Germany 2,755; Italy 1,287.
Unwrought	3,176	6,819	West Germany 4,550; France 823.
Semimanufactures	123,510	103,139	United States 28,284; Netherlands 14,918; France 12,382.
Bismuth metal, including alloys, all forms	116	61	France 45.
Cadmium metal, including alloys, all forms	681	656	West Germany 363; France 118.
Chromium:			
Chromite	6	65	NA.
Metal, including alloys, all forms	4	-------	
Copper:			
Ore and concentrate	7,300	3,137	All to West Germany.
Metal, including alloys, all forms:			
Scrap	17,934	14,338	West Germany 7,463; France 2,441; Italy 1,320.
Unwrought	262,983	286,407	France 79,384; West Germany 58,674; Netherlands 35,973.
Semimanufactures	81,287	174,452	Netherlands 77,435; United States 18,417.
Germanium metal, including alloys. kilograms	5,100	7,300	West Germany 5,000; Italy 1,200.
Gold metal, unworked or partly worked. thousand troy ounces	1,078	130	France 58; Switzerland 18; United States 15.
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	22	62	France 53; West Germany 7.
Roasted pyrite ---do	210	230	West Germany 228.
Metal:			
Scrap ---do	741	818	West Germany 371; France 298.
Pig iron, including cast iron, sponge iron, powder and shot. ---do	75	97	France 47; West Germany 35.
Ferroalloys ---do	69	67	United States 23; Italy 18; France 14.
Steel, primary forms ---do	1,149	1,094	France 468; Italy 170; West Germany 163.
Semimanufactures:			
Bars, rods, angles shapes, sections. ---do	4,062	4,244	United States 1,042; West Germany 670; Netherlands 631; France 553.
Universals, plate and sheet ---do	2,656	3,133	France 896; West Germany 707.
Hoop and strip ---do	714	724	France 183; West Germany 169; Netherlands 82.
Rails and accessories ---do	81	66	Netherlands 10; United States 9; Switzerland 7.
Wire ---do	324	325	United States 87; West Germany 38.
Tubes, pipes and fittings ---do	226	193	Netherlands 46; France 38; United States 17.
Castings and forgings, rough	30	r 53	Netherlands 24; France 6; Sweden 5; West Germany 5.
Lead:			
Ore and concentrate	6,521	1,051	All to West Germany.
Oxides	5,228	5,810	Netherlands 4,543; West Germany 467.
Metal including alloys:			
Scrap	2,264	2,262	France 2,161.
Unwrought	56,951	58,069	Netherlands 16,537; United States 13,279; France 11,082.
Semimanufactures	8,114	7,279	Netherlands 2,610; Sweden 550.
Magnesium metal, including alloys, all forms	391	176	United States 133.
Manganese ore and concentrate	1,221	2,586	United Kingdom 1,100; West Germany 847.
Nickel:			
Matte, speiss, and similar materials	174	-------	
Metal, including alloys:			
Scrap	470	599	West Germany 208; United Kingdom 112; Netherlands 107.
Unwrought	16	24	West Germany 12; Italy 10.
Semimanufactures	262	270	NA.
Platinum-group metals, including alloys, all forms. thousand troy ounces	1,057	15	West Germany 10; United States 1.
Selenium, elemental ---kilograms	41,400	32,800	U.S.S.R. 6,600; France 5,800; West Germany 4,200.
Silver, metal, including alloys. thousand troy ounces	9,214	8,112	West Germany 2,926; Netherlands 2,871; France 1,463.
Tellurium and arsenic ---kilograms	300	7,100	NA.

See footnote at end of table.

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Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Tin:			
Ore and concentrate—long tons	r 53	362	Netherlands 194; Spain 168.
Oxides—do	143	130	West Germany 42; Netherlands 40; France 37.
Metal, including alloys:			
Scrap—do	174	126	West Germany 41; United Kingdom 23; Denmark 23; Netherlands 22.
Unwrought—do	3,660	3,882	West Germany 1,186; France 1,188; Netherlands 663.
Semimanufactures—do	243	92	West Germany 31; Switzerland 20; France 12.
Tungsten:			
Ore and concentrate	25	6	NA.
Metal, including alloys, all forms	8	4	Netherlands 1.
Zinc:			
Ore and concentrate	12,758	26,853	France 19,970; Poland 3,470; Netherlands 826.
Metal, including alloys:			
Scrap	7,676	7,155	France 6,346.
Blue powder	15,381	36,353	West Germany 9,545; France 5,925.
Unwrought	147,320	136,170	West Germany 62,225; United States 14,733.
Semimanufactures	14,586	9,653	France 3,327; Pakistan 1,195; Italy 1,084.
Other:			
Ore and concentrate	510	105	United States 54.
Ash and residues containing nonferrous metals:			
Lead	10,753	1,504	West Germany 690; Netherlands 563; United Kingdom 222.
Zinc	20,660	10,222	Netherlands 5,576; West Germany 2,811; France 1,799.
Other	7,765	8,695	France 5,187; West Germany 3,268.
Metals, including alloys, all forms	13,484	8,820	United States 2,873; Japan 2,315.
NONMETALS			
Abrasives, natural, pumice, emery, natural corundum.	307	492	NA.
Barite and witherite	-------	45	NA.
Boron materials:			
Crude natural borates	42	4,436	Netherlands 4,421.
Oxide and acid	4	18	NA.
Cement—thousand tons	1,424	1,338	Netherlands 1,094.
Chalk	85,679	103,754	Netherlands 75,157; West Germany 7,555.
Clay and clay products:			
Crude clays:			
Kaolin	936	1,240	Netherlands 1,060.
Refractory	8,171	6,855	Netherlands 2,982; France 2,338.
Other	18,650	7,579	France 3,733; Netherlands 3,674.
Products:			
Refractory (including nonclay bricks)	38,390	21,748	France 8,789; Netherlands 6,117.
Nonrefractory—thousand tons	178	32	Netherlands 20; West Germany 8.
Diamond:			
Gem, not set or strung—thousand carats	3,731	3,736	India 1,088; United States 882; Israel 400.
Industrial—do	r 9,990	9,795	United Kingdom 3,981; United States 2,111.
Diatomite and other infusorial earths	852	870	France 742.
Fertilizer materials:			
Crude:			
Nitrogenous	575	44	NA.
Phosphatic	30,898	21,095	Netherlands 7,202; United Kingdom 3,803; Switzerland 3,641.
Potassic	2,375	1,242	NA.
Manufactured:			
Nitrogenous (content of nitrogen)	r 144,170	178,400	West Germany 67,990; mainland China 40,519.
Phosphatic (content of P_2O_5)	322,530	327,870	France 123,140; West Germany 76,580.
Potassic (content of K_2O)	476,530	555,860	United States 82,590; United Kingdom 78,310.
Other bulk—thousand tons	331	477	France 330; Netherlands 51.
Ammonia	55,567	61,573	France 56,372.
Fluorspar	10	25	NA.
Graphite, natural	-------	5	NA.
Gypsum and plasters	14,314	10,694	Netherlands 10,130.
Lime—thousand tons	373	442	Netherlands 352.
Mica:			
Crude including splittings and waste	30	88	NA.
Worked, including agglomerated splittings.	196	297	United Kingdom 106; Switzerland 54; West Germany 47.

See footnote at end of table.

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Table 2.—Belgium-Luxembourg: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Pigments, mineral, including processed iron oxides.	262	220	West Germany 66; France 48; United Kingdom 41.
Precious and semi- thousand carats.. precious stone, except diamond, including synthetic stones.	53,243	45,054	United States 6,263; Congo (Kinshasa) 1,000.
Salt	4,259	3,869	France 3,456.
Stone, sand and gravel:			
Dimension stone, thousand tons.. crude and partly worked, calcareous, marble, and other.	1,908	1,294	Netherlands 1,275.
Dolomite, chiefly thousand tons.. refractory grade.	475	623	Netherlands 384; France 131.
Gravel and crushed rock ..do....	4,903	5,477	France 2,753; Netherlands 2,284.
Limestone ..do....	r 780	807	Netherlands 691.
Quartz and quartzite	64,776	71,555	Netherlands 26,340; West Germany 11,682; France 9,315.
Sand, including metal thousand tons.. bearing.	3,194	2,886	France 1,030; Italy 420; West Germany 291.
Sulfur:			
Elemental, all forms	9,440	10,249	Pakistan 2,233; France 2,090; Brazil 1,807.
Sulfuric acid	84,888	83,180	West Germany 45,069; France 22,375; Netherlands 9,493.
Talc, steatite, soapstone and pyrophyllite	1,511	8,485	Sweden 2,397; France 1,490; West Germany 1,152.
Other nonmetals n.e.s.:			
Slag, dross and similar waste, not metal bearing:			
From iron and thousand tons.. steel manufacture.	1,660	2,143	Netherlands 1,104; France 524; West Germany 498.
Slag and ash n.e.s.	213,193	81,855	Netherlands 41,709; France 24,531.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	373	196	West Germany 87.
Carbon black	4,052	3,221	NA.
Coal and briquets:			
Anthracite and bi- thousand tons.. tuminous coal.	1,217	1,524	Netherlands 844; France 334.
Briquets of anthracite and do.... bituminous coal.	103	94	France 78.
Coke and semicoke ..do....	420	414	France 191; West Germany 101; Sweden 69.
Gases, all kinds	58,057	71,776	Spain 25,762; France 10,630; Argentina 10,629.
Petroleum:			
Crude, and partly refined ..do....	160	275	West Germany 240.
Refinery products:			
Gasoline, including natural..do....	853	1,400	United Kingdom 443; West Germany 330; Netherlands 307; Switzerland 144.
Kerosine and jet fuel ..do....	486	239	Netherlands 228.
Distillate fuel oil ..do....	1,365	4,968	West Germany 3,864.
Residual fuel oil ..do....	2,415	2,455	United Kingdom 461; West Germany 434; Liberia 270; Norway 256.
Lubricants ..do....	165	174	Netherlands 63; Switzerland 22.
Mineral jelly and wax	442	397	Italy 76; France 68; West Germany 41.
Pitch coke	17,661	58,049	France 50,765.
Petroleum coke	r 27,779	32,521	United Kingdom 16,100; West Germany 6,437; Norway 5,345.
Bitumen and other residues	230,483	236,889	Netherlands 160,762; United Kingdom 37,821.

r Revised. NA Not available.

1.025 million tons of coils supplemented by the production of 658,000 tons of fine sheets in the cold rolling mills. At yearend the monthly production rate corresponded to an annual production rate of 1.5 million tons. Production costs at the Ghent plant were reportedly low reflecting its favorable location and good design. Opening of the Ghent-Terneuzen canal to large ore carriers will furthermore improve the economics of the operation.

Lead and Zinc.—In 1968 Belgium's lead and zinc industry produced about 96,000 tons of lead and slightly over 254,300 tons of zinc. Belgium has no lead and zinc mines and all production was based on imported raw materials. Of total imports of zinc raw materials, approximately 48

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	9,699	8,103	Guyana 5,808; West Germany 901.
Oxide and hydroxide	13,289	14,007	West Germany 7,465; France 5,101.
Metal, including alloys:			
Scrap	1,793	1,729	Netherlands 604; France 357; United States 293.
Unwrought	152,550	139,983	France 60,556; United States 19,884; West Germany 15,360.
Semimanufactures	25,260	22,760	West Germany 10,068; France 6,947; Netherlands 3,500.
Antimony:			
Ore and concentrate	7,930	8,827	Bolivia 3,764; mainland China 1,499; Morocco 982.
Metal, including alloys, all forms	104	110	Mainland China 52; Netherlands 46.
Beryllium metal, including alloys, all forms kilograms	200	380	Netherlands 360.
Bismuth metal, including alloys, all forms	99	91	Canada 42; Netherlands 30.
Cadmium metal, including alloys, all forms	521	398	Congo (Kinshasa) 212; Netherlands 78.
Chromium:			
Chromite	1,710	2,132	Mozambique 845; Philippines 534; Netherlands 277.
Oxide and hydroxide	390	446	West Germany 225; France 77; U.S.S.R. 73.
Metal, including alloys, all forms	11	31	France 11; West Germany 7.
Cobalt oxides and hydroxides. kilograms	1,600	280	Not reported by country; all from European Economic Community.
Copper:			
Ore and concentrate	12,146	10,778	United States 4,328; Peru 1,886.
Metal, including alloys:			
Scrap	56,852	49,348	Netherlands 12,068; France 11,169; West Germany 8,933.
Unwrought	343,952	312,571	Congo (Kinshasa) 182,326; Chile 25,429.
Semimanufactures	r 16,997	16,833	West Germany 7,069; Netherlands 1,680.
Germanium metal, including alloys	31	88	Netherlands 83.
Gold metal, unworked and partly worked:			
Unwrought troy ounces	r 667,173	1,247,942	United Kingdom 791,612; Congo (Kinshasa) 248,327.
Semimanufactures	r 63,074	37,698	NA.
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	11,407	21,874	France 11,695; Sweden 6,332.
Roasted pyrite do	145	127	West Germany 44; Italy 40; France 33.
Metal:			
Scrap do	193	196	France 92; Netherlands 56; United Kingdom 11.
Pig iron, including cast iron, sponge iron, powder and shot. do	210	192	France 66; West Germany 32; East Germany 24; Netherlands 24.
Ferroalloys do	116	107	France 44; Norway 39.
Steel, primary forms do	632	827	Netherlands 219; West Germany 211; France 159.
Semimanufactures:			
Bars, rods, angles, shapes, sections	379	374	France 188; West Germany 77.
Universals, plate and sheet	406	353	West Germany 171; France 103.
Hoop and strip	34	37	France 15; West Germany 13.
Rails and accessories	8	6	France 3; West Germany 2.
Wire	11	18	West Germany 10.
Tubes, pipes, and fittings	77	161	Netherlands 77; West Germany 29.
Castings and forgings, rough	4	18	West Germany 6; Netherlands 5; France 4.
Lead:			
Ore and concentrate	184,537	130,159	Canada 62,690; Ireland 35,318; Peru 16,093.
Oxides	2,258	2,046	Netherlands 1,235; West Germany 205.
Metal including alloys:			
Scrap	13,502	8,587	Netherlands 4,089; West Germany 3,316.
Unwrought	13,765	8,143	West Germany 3,814; United Kingdom 1,128; Netherlands 1,050.
Semimanufactures	1,348	923	West Germany 566; Netherlands 163.
Magnesium metal, including alloys:			
Scrap	330	79	West Germany 33; Italy 11.
Unwrought	1,091	638	U.S.S.R. 302; Italy 259.
Semimanufactures	54	75	United States 39; West Germany 9; France 8.

See footnote at end of table.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Manganese:			
Ore and concentrate	258,890	285,499	Republic of South Africa 128,265; U.S.S.R. 50,159; Angola 46,285; India 36,495.
Oxides	1,552	1,816	Netherlands 1,665.
Metal	278	219	West Germany 139; France 27; Republic of South Africa 25.
Mercury 76-pound flasks	1,363	4,548	West Germany 1,210; Netherlands 1,062.
Molybdenum metal, including alloys, all forms.	10	10	Netherlands 4; Austria 2.
Nickel:			
Matte, speiss, and similar materials	1,218	50	Netherlands 25; United Kingdom 16; France 7.
Metal:			
Scrap	559	1,252	France 440; Netherlands 223; United States 194; West Germany 184.
Unwrought	170	1,263	United Kingdom 905; Norway 157.
Semimanufactures	705	1,280	West Germany 192; United Kingdom 170; United States 149.
Platinum-group metals, troy ounces including alloys, all forms.	25,926	39,597	United Kingdom 18,055; France 8,585; Netherlands 7,604.
Selenium, elemental kilograms	300	240	NA.
Silver:			
Waste and sweepings. value thousands	$1,790	$5,957	NA.
Metal, including alloys. thousand troy ounces	14,348	10,198	United Kingdom 5,649; Netherlands 2,836.
Tellurium, elemental, including arsenic	30	51	Sweden 48.
Tin:			
Ore and concentrate long tons	6,906	5,943	Congo (Kinshasa) 4,511.
Oxides do	14	14	West Germany 7; United Kingdom 4.
Metal, including alloys:			
Scrap do	23	17	Netherlands 8; Senegal 5.
Unwrought do	3,255	2,762	Congo (Kinshasa) 1,589; Netherlands 634.
Semimanufactures do	191	117	Netherlands 93.
Titanium:			
Ore and concentrate	1,556	14,877	Canada 10,095; Norway 3,544.
Oxides	10,300	11,657	West Germany 7,414; Japan 1,648.
Metal, including alloys, all forms	10	14	France 4; Netherlands 1.
Tungsten:			
Ore and concentrate	87	59	Netherlands 26; Congo (Kinshasa) 10; Kenya 10.
Metal including alloys, all forms	13	16	Netherlands 12.
Zinc:			
Ore and concentrate	538,637	525,689	Canada 307,108; Congo (Kinshasa) 58,260.
Oxide and peroxide	1,825	2,104	Netherlands 1,037; United States 614; France 230.
Metals, including alloys:			
Scrap	704	893	West Germany 463; Netherlands 271.
Blue powder	341	792	West Germany 762.
Unwrought	11,630	14,245	Canada 4,852; Australia 3,852; North Korea 1,625.
Semimanufactures	212	296	Netherlands 118, West Germany 101.
Zirconium and hafnium metal, including alloys, all forms. kilograms	500	700	Sweden 200.
Other:			
Ore and concentrate	12,891	7,961	Morocco 3,005; United States 1,547.
Ash and residues containing nonferrous metals.	125,092	93,761	West Germany 56,172; France 24,258.
NONMETALS			
Abrasives, natural	172,368	198,482	West Germany 197,590.
Asbestos	52,514	55,774	Canada 36,165; Republic of South Africa 7,847.
Barite and witherite	14,912	5,982	France 3,593; West Germany 1,506.
Boron materials, crude natural borates	11,819	16,927	Netherlands 9,406; Turkey 4,806; United States 1,868.
Bromine kilograms	20,300	800	NA.
Cement	43,867	103,505	West Germany 21,280; Netherlands 9,756.
Chalk	54,849	69,455	Netherlands 36,268; France 29,588.

See footnote at end of table.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Clay and clay products:			
Crude clays:			
Kaolin	93,493	95,404	United Kingdom 74,282.
Other	269,016	249,515	West Germany 156,792; France 89,853.
Products:			
Refractory, including nonclay bricks.	72,084	75,538	West Germany 48,866; Austria 8,055.
Nonrefractory	152,216	66,569	Netherlands 52,273.
Cryolite and chiolite	138	258	Denmark 231.
Diamond:			
Gem, not set or strung:			
Rough stones...thousand carats	7,134	6,972	United Kingdom 5,834.
Worked...do	566	598	India 160; Republic of South Africa 86; Hong Kong 68; United Kingdom 62.
Industrial...do	10,297	9,531	United Kingdom 4,814; Ireland 1,540.
Diatomite and other infusorial earths	--------	7,054	Denmark 2,461; United States 2,155; France 1,109.
Feldspar	33,692	34,795	Canada 9,345; Norway 9,137; France 6,831.
Fertilizer materials:			
Crude:			
Nitrogenous	27,668	15,809	Chile 15,750.
Phosophatic...thousand tons	1,200	1,469	Morocco 1,120.
Potassic	1,371,853	1,350,973	France 985,760.
Manufactured:			
Nitrogenous (content of nitrogen)	201,105	59,875	West Germany 32,510; France 17,997.
Phosphatic (content of P_2O_5)	2,277	864	Mostly EEC countries.
Potassic (content of K_2O)	[2] 301,210	705,826	France 54,205.
Other	83,709	150,233	France 69,914; West Germany 55,925.
Fluorspar	6,591	9,932	France 6,988; mainland China 1,327; East Germany 1,035.
Graphite, natural	627	546	France 199; Austria 112; Norway 111.
Gypsum and plasters	449,106	439,153	France 405,763.
Lime	88,641	88,063	France 85,490.
Magnesite	3,731	3,600	Austria 1,060; Czechoslovakia 871; Netherlands 586.
Mica, all forms	1,202	1,342	United Kingdom 398; Norway 339; Malagasy Republic 140.
Pigments, mineral:			
Natural, crude	635	778	West Germany 516; France 88.
Iron oxides processed	6,750	6,306	West Germany 5,881.
Precious and semiprecious stone, except diamond:			
Natural and manufactured...grams	2,932,491	2,170,039	United States 1,546,807; Tanzania 90,425; Ireland 25,625.
Dust and powder...value thousands	$3,016	$2,904	Ireland $1,163; United States $770; United Kingdom $344.
Pyrite (gross weight)	264,013	276,139	Portugal 179,681; U.S.S.R. 31,041; Cyprus 30,264.
Salt, including brine...thousand tons	847	944	West Germany 458; Netherlands 433.
Stone, sand and gravel:			
Dimension stone, slate, including worked.	13,321	16,713	France 7,094; Portugal 3,392; West Germany 2,777.
Dolomite	23,487	39,760	France 21,761; West Germany 13,928.
Gravel and crushed rock. thousand tons	4,748	4,365	West Germany 2,559; Netherlands 1,042.
Limestone, except dimension	79,371	72,821	France 68,399.
Quartz and quartzite	14,056	12,088	West Germany 5,733; Norway 1,810; Netherlands 1,705.
Sand, including metal bearing. thousand tons	7,077	7,457	Netherlands 6,318.
Sulfur:			
Elemental	219,030	224,113	United States 169,054.
Sulfur dioxide	252	5,931	West Germany 5,708.
Sulfuric acid	25,107	40,177	Netherlands 20,938; West Germany 15,646.
Talc, steatite, soapstone and pyrophyllite	36,133	26,825	United States 10,750; Austria 5,383; Norway 5,072.
Other nonmetals n.e.s.:			
Crude	4	2	NA.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture	209,677	231,380	West Germany 84,447; France 36,151; Netherlands 25,014.
Slag and ash n.e.s	22,325	16,579	Netherlands 11,284; West Germany 3,448.

See footnote at end of table.

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Table 3.—Belgium-Luxembourg: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	7,427	7,705	Trinidad and Tobago 2,067; United States 918.
Carbon black	17,787	17,608	Netherlands 5,867; West Germany 4,921; France 4,195.
Coal and briquets:			
Anthracite and bituminous. thousand tons	6,219	5,888	West Germany 2,947; United States 1,190; Netherlands 1,156.
Briquets of anthracite and bituminous coal. do	346	331	Netherlands 280.
Lignite and lignite briquets do	174	137	West Germany 132.
Coke and semicoke do	3,628	3,702	West Germany 2,604; Netherlands 1,016.
Gases, all kinds do	r 1,391	36,727	Netherlands 35,512; France 766; West Germany 413.
Peat, including peat briquets do	58	50	Netherlands 25; West Germany 24.
Petroleum:			
Crude and partly refined do	16,587	17,588	Libya 4,318; Iran 3,298; Kuwait 2,768; Venezuela 2,136.
Refinery products:			
Gasoline, including natural do	342	581	Netherlands 213; Italy 151; West Germany 77.
Kerosine and jet fuel do	33	50	Netherlands 28; Rumania 21.
Distillate fuel oil do	1,894	2,666	Italy 742; Netherlands 399.
Residual fuel oil do	2,551	2,570	Netherlands 846; Italy 635; West Germany 420.
Lubricants do	292	287	United States 76; Netherlands 66; France 39.
Mineral jelly and wax do	10	9	West Germany 3; France 2; United States 1.
Pitch coke	2,689	468	West Germany 349.
Petroleum coke thousand tons	98	91	United States 87.
Bitumen and other residues do	43	65	France 56.

r Revised. NA Not available.

percent came from Canada; roughly 11 percent was imported from the Congo (Kinshasa) and about 7 percent was purchased in Finland. Lead raw materials came from Canada (48 percent) and Finland (27 percent).

The Société des Mines et Fonderies de Zinc de la Vieille-Montagne and Compagnie de Metaux Overpelt-Lommel continued as the principal producers of lead and zinc in the country. At the Vieille Montagne plant at Balen a new facility for the continuous leaching of ores was brought into production during 1968.

In addition, zinc production at Overpelt-Lommel plants was increased from 81,000 tons in 1967 to 83,000 tons in 1968 by improvement in the reduction furnaces and without the employment of additional labor.

Titanium.—The West German concern, Farbenfabriken Bayer planned to build a new titanium dioxide plant in Antwerp. The plant will have an initial capacity of 20,000 tons of titanium dioxide per year and is scheduled for production in the early 1970's. The plant will employ the conventional sulfate method for titanium dioxide production.

Other Nonferrous Metals.—Belgium produced a number of other nonferrous metals as byproducts of its copper, lead, and zinc smelting operations during 1968. Among the most significant were cadmium, bismuth, germanium, selenium, and precious metals. In addition, Belgium produced from imported raw materials significant quantities of cobalt and radioactive materials, substantial quantities of which were exported. Detailed data on production and trade in these commodities are not readily available.

Nonmetals.—Belgium's production of nonmetals in 1968 included cement, clays, lime, manufactured fertilizers, and quarry products. The nonmetallic sector of the mining industry employed slightly over 10,000 persons.

Cement.—Belgian cement output in 1968 registered a modest gain over that of 1967. Production might have been higher had it not been for spring strikes in the Belgian building industry. Because market condi-

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tions were changing and cement industries in other countries were being expanded, it was difficult to obtain long-term export contracts. Most export arrangements were for short-term supplies to cover temporary shortages. The Belgian industry was therefore oriented toward the domestic market and was trying to increase home consumption of cement.

Cement producers operated 14 plants with 28 kilns in 1968. The largest producers were S.A. Cimentries CPB with five plants (Harmignies, Langerbrugge, Lixhe, Marchinenne, and Obourg) and a total cement capacity of 2.2 million tons per year, and Ciments d' Obourg S.A. with one plant at Obourg having annual capacity of 1.5 million tons. The cement industry was further modernized and automated in 1968. The second phase of plant modernization at Lixhe was begun during the year and it is expected that by 1970 the grinding and dispatching capacity will have been brought into line with the plant's clinker production capacity.

Diamond, Precious Stones, and Gems.—Belgium continued to be a significant processor of imported raw diamonds and other gems and precious stones. Foreign trade in those items was a significant source of foreign exchange. During 1967 Belgium imported diamonds, precious stones and gems valued at $274.9 million while exports totaled $309.4 million. Foreign competition and the lack of replacements for aging diamond cutters hampered operations and raised problems for the future of the industry.

Mineral Fuels.—Liquid fuels and natural gas continued to provide an increasing share of Belgium's total fuel requirements during 1968. Petroleum consumption continued to rise and in 1968 liquid fuels became the principal source of energy in the country. Domestic coal was the energy source principally displaced by competition from oil and gas.

Coal.—Both anthracite and bituminous coals were produced in Belgium with the high-volatile coals produced in the Campine Basin, and the lower volatiles in the southern fields. Approximately 57 percent of national output in 1968 was obtained from the Campine mines.

The continued rationalization of Belgium's coal industry during 1968, resulted in the closing of additional domestic mines, lower overall coal production and mine employment, and higher productivity. The primary reason for the mine closures was the Government's desire to reduce the volume of subsidies, which in 1968 again exceeded 4.5 billion Belgian francs (about $900 million).

Four mines were closed by the Directory of the Coal Mining Industry, during the year and total coal production declined from 16.4 million tons in 1967 to 14.8 million tons in 1968. These closures and the resulting decline in output lowered coal stocks at the mines from 2.8 million tons in 1967 to 1.8 million in 1968. Productivity per underground manshift excluding supervisory personnel, in Belgium's mines rose from 2,012 kilograms in 1967 to an average of 2,226 kilograms in 1968. The concentration of production at mines and basins with less complicated underground structures contributed to increased productivity.

Belgium was a net coal importer during 1968. Coal imports increased from about 6.2 million tons in 1967 to approximately 6.9 million tons in 1968. Exports of coal on the other hand declined from 1.6 million tons in 1967 to 1.2 million tons in 1968. The apparent consumption of coal remained at approximately the same level as in 1967 (about 21.5 million tons). Imported coal and coal from stocks compensated for the decreased supply resulting from lower domestic production.

As in past years the principal consumers of coal in 1968 were the iron and steel industry, electric powerplants, and households.

Petroleum and Natural Gas.—The growth of Belgium's petroleum refining industry continued during 1968, as several refineries were expanded and a new one at Ghent, with an annual capacity of 5 million tons, was completed. As there was no domestic production of crude oil or natural gas, the country was completely dependent on imports of these two commodities.

Exploration for liquid and gaseous hydrocarbons was almost nonexistent. Some land acquisitions by Petrofina in the Provinces of Liège, Namur, Luxembourg, and Limburg were reported.

Most of Belgium's refinery capacity was located in the Antwerp area. However, the new Ghent refinery may be the start of a trend that will make that city a second petroleum refining center. The $100 mil-

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lion Texaco Plant at Ghent has increased Belgium's refining capacity by an additional 5 million tons of crude oil per year. A maritime terminal was built at Zeebrugge to facilitate the movement of crude oil to the new refinery. The terminal can accommodate tankers up to 65,000 deadweight tons and is connected with the Ghent refinery by a 20-inch diameter pipeline.

In addition to the Ghent refinery the capacities of existing refineries were increased. The SIPB[2] (Société Industrielle Belge des Petroles S.A.) refinery was expanded to a capacity of 14 million tons of crude oil per year. Albatros S.A. replaced its old 1-million-ton-per-year refinery with a new one having a capacity of 2.3 million tons.

The employment of large tankers to move oil around Africa, as a result of the closure of the Suez Canal, has raised problems because they cannot be accommodated at Belgian ports. As a partial solution of the problem the Government has granted permission for the construction of a crude oil pipeline connecting the port of Rotterdam with refineries near Antwerp owned by Petrofina, British Petroleum, and Esso. The pipeline will be 65 miles long, 32 inches in diameter and have an initial capacity of 20 million tons per year when completed.

New conditions stipulated in the contract for imports of natural gas from the Netherlands made the transaction more favorable for Belgium's sole gas distributor, "Distrigas." Deliveries from Groningen in the Netherlands will be increased from the 1967 level of 5,000 million cubic meters to 7,500 million cubic meters in the early 1970's. At yearend 1968 natural gas reached about 30 percent of Belgium's 1.5 million gas consumers.

LUXEMBOURG

During 1968 the iron and steel industry of Luxembourg was the only segment of the country's mineral industry that was of significance by European standards. Because of its predominant position, this industry determined the overall trends in the mineral industry, as well as in the national economy. Production of other minerals mostly nonmetallics, was of local importance only.

The gross national product (GNP) at current prices increased by 6 percent in 1968 according to preliminary data. There is no recent information on the proportion of GNP accounted for by the mineral extractive and processing industries. Because of the recent leveling off in iron ore production and the diversification of the country's economy, the minerals industry share of total GNP can be judged to be declining.

Foreign trade data of Luxembourg were reported together with that of Belgium. Although the data cannot be separated, it is known that imports of iron ore, nonferrous metals, and fuels were essential to supply Luxembourg's mineral processing industries. Products of the iron and steel industry were the principal commodities exported from the country.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—The iron and steel industry was by far the most important segment of the country's minerals industry in 1968. The industry employed about 47 percent of all wage earners and was one of the most important factors influencing the overall economic activity of the country.

Reserves of iron ore amounted to about 200 million tons at the beginning of 1967 and the deposits covered an area equal to approximately 1.4 percent of the country's total surface. Iron ore production was confined to the southern part of Luxembourg. The metal content of ore was low and varied between 20 and 33 percent, averaging about 28 percent.

There were 13 mines in operation of which nine were open pit and four were underground. Production of iron ore remained roughly at the same level as in 1967 and totaled 6.4 million tons. Domestic output was inadequate to cover demand and imports of iron ore, mostly from France, were essential for the operation of the steel industry.

Steel production totaled 4.8 million tons in 1968, an increase of about 7 percent over that of 1967. The steel producers

[2] Owned jointly by British Petroleum (BP) and Petrofina.

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Table 4.—Luxembourg: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 •
METALS					
Iron ore and concentrate	6,680	6,315	6,528	6,304	6,400
Pig iron (including blast furnace ferroalloys)	4,191	4,145	3,962	3,963	4,000
Steel ingots and castings	4,559	4,585	4,390	4,481	4,800
Semimanufactures	3,589	3,602	3,449	3,581	NA
NONMETALS					
Cement, hydraulic	205	222	212	183	NA
Gypsum, and anhydrite, crude	7	5	6	11	NA
Lime, hydrated	2	1	1	-------	NA
Fertilizers, manufactured: Phosphatic:					
Thomas slag, gross weight	818	887	777	• 750	730
Other (P_2O content)	125	• 127	• 127	120	110
Quartz, quartzite and glass sand--thousand cubic meters	24	27	36	27	25
Stone, sand and gravel, n.e.s.:					
Molding sand	40	40	22	28	24
Stone:					
Building stone:					
Rough cut--thousand cubic meters	49	48	30	• 25	20
Facing--thousand square meters	5	9	• 8	• 6	5
Cut stone:					
Crude--thousand cubic meters	1	1	1	1	1
Flagstone--thousand square meters	3	4	NA	NA	NA
Crushed rock--thousand cubic meters	468	441	162	• 160	150
Dolomite	254	225	168	171	170
Limestone	36	27	51	30	28
Paving blocks--thousand pieces	70	50	44	• 35	33
MINERAL FUELS AND RELATED MATERIALS					
Coke, gas plant	28	13	• 10	• 10	10
Manufactured gas--million cubic meters	24	26	25	25	24

• Estimate. NA Not available.

operated 23 to 25 blast furnaces, seven steel plants, and six rolling mills. Thomas steel accounted for about 85 percent of total production and oxygen converter steel for about 13 percent; the rest was electric steel.

ARBED (Acieries Reunies de Burback-Eich-Dudelange, Société Anonime, Luxembourg) was the largest iron and steel producer in the country during 1968.

Other Minerals.—Domestic production of minerals other than iron ore was small and consisted of nonmetallics only.

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The Mineral Industry of Bolivia

By Robert A. Whitman[1]

Bolivian mineral production was slightly lower in 1968 than in 1967, but export earnings increased about 6 percent. Tin remained the dominant mineral. In 1968, the mineral industry, including petroleum, accounted for about 95 percent of the total value of all commodity exports, with tin accounting for two-thirds of the nonfuel minerals value and over one-half of the total export earnings. The petroleum sector was second in foreign exchange earned and in the number of persons employed.

Although the semiautonomous, state-owned Corporación Minera de Bolivia (COMIBOL) was free of work stoppages from strikes during the year, this was mainly the result of rigid control by the army and police units. Through increased productivity and layoffs of nonproductive personnel, COMIBOL reduced the average cost of mining a pound of tin to about 5 cents below the average 1968 world market price. COMIBOL reportedly paid taxes of around $900,000 to the Bolivian Government during 1968.

With the enactment in April of Supreme Decree No. 08341, Bolivia's petroleum code was canceled. The code's liberal terms had been responsible for attracting the foreign investment to support exploration which resulted in the growth of the petroleum industry since 1956. After the code became effective in 1955, over a dozen oil companies entered into agreements for exploration in 1956. Supreme Decree No. 08341 prevents further concessions for either exploration or exploitation except by direct negotiation with the Executive Power. The decree also states that companies will be expected to offer to the Bolivian Government substantially better conditions than those of the superseded code. No new petroleum code is expected to be introduced until late 1969. A translation of the decree is given in the Petroleum and Natural Gas section.

In December the National Congress passed a bill permitting the Caja de Pensiones y Jubilaciónes Militares (CPJM) to develop its sulfur and other mineral deposits through joint operating or mixed enterprise contracts with either private national or foreign companies. Although CPJM must retain majority control, this is an important departure from the general law prohibiting any foreigners from operating in a zone within 50 kilometers of the borders.

PRODUCTION

Production of most metals except zinc gained slightly. Silver production gained 15 percent while that of gold was up 24 percent. One company announced the stockpiling of 33,000 ounces of gold awaiting improvement in the world market price. The production of sulfur, as measured by exports, dropped about 28 percent apparently because some firms withdrew from the association of sulfur producers to await higher world prices. Production of natural gas increased about 7 percent but there was little change in the production of crude petroleum or refinery products.

[1] Physical scientist, Division of International Activities.

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Table 1.—Bolivia: Approximate production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS [1]					
Antimony:					
Mine output, metal content [2]	9,658	9,628	10,667	11,276	11,117
Metal [3]	38	6	27	8	62
Beryllium, beryl concentrate, [3] gross weight	30	--	--	--	1
Bismuth, mine output, metal content	272	272	449	502	575
Cadmium, mine output, metal content kilograms	--	5,740	2,400	NA	NA
Copper, mine output, metal content	4,734	4,736	5,827	6,087	6,924
Gold, mine output, metal content troy ounces	128,576	94,314	86,982	55,069	68,266
Lead:					
Mine output, metal content	16,954	17,249	20,620	19,973	22,325
Metal, including secondary	461	936	1,130	237	NA
Mercury, mine output, metal content 76-pound flasks	[4] 32	52	4	[3] 100	134
Silver, mine output, metal content thousand troy ounces	4,517	3,987	4,919	4,515	5,180
Tin:					
Mine output, metal content long tons	24,319	23,036	25,626	26,890	28,576
Metal, including secondary do	3,610	3,415	1,062	800	--
Tungsten, mine output, metal content	955	866	1,253	1,588	1,811
Zinc, mine output, metal content	9,592	13,607	16,008	16,754	11,785
NONMETALS					
Asbestos	[4] 139	[4] 178	26	4	1
Cement, hydraulic thousand tons	64	60	60	62	71
Gypsum and anhydrite, crude [2]	700	475	1,960	1,100	1,600
Salt, all types [2]	3,563	13,825	11,223	4,445	NA
Sulfur, elemental [2]	10,806	9,455	r 58,457	49,312	35,429
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, gross production million cubic feet	[5] 4,145	8,103	12,033	30,465	32,679
Natural gas liquids:					
Natural gasoline 42-gallon barrels	64,321	54,605	68,861	65,661	NA
Liquefied petroleum gas do	NA	NA	273	3,142	NA
Petroleum:					
Crude oil thousand 42-gallon barrels	3,290	3,357	6,085	14,527	14,991
Refinery products:					
Gasoline, motor do	r 1,126	1,182	1,352	1,507	1,652
Kerosine do	467	512	571	653	696
Distillate fuel oil do	506	596	615	752	624
Residual fuel oil do	790	819	863	792	1,020
Other do	13	65	16	33	35

p Preliminary. r Revised. NA Not available.
[1] COMIBOL production plus exports by small and medium mines and smelters unless otherwise noted.
[2] Mine output, metal content. Derived figure is a total of metal content of ores and concentrates exported without further processing plus metal recovered in various metallurgical processes during year indicated.
[3] Exports by small and medium mines.
[4] Purchases by Banco Minero.
[5] Commercial production, processed for domestic fuel and for export.

TRADE

Bolivia may have had a slightly favorable balance of trade in 1968. Preliminary figures showed a gain in the value of mineral exports of about $7.6 million for 1968 over 1967 totals and a gain for petroleum exports of about $600,000. Metallic minerals continued to dominate the export trade with tin still the leading mineral. There was a slightly smaller quantity of crude petroleum exported and no gas was exported in 1968.

The relation of mineral trade to total trade for 1966 and 1967 is tabulated below:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	125	132
1966	132	150
1967	131	166
Imports:		
1965	18	134
1966	17	138
1967	15	151
Trade balance:		
1965	+107	−2
1966	+115	+12
1967	+116	+15

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Table 2.—Bolivia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Antimony:		
Ore and concentrate	10,640	11,468
Metal, including alloys, all forms	27	8
Bismuth, ore and concentrate	373	531
Cadmium metal, including alloys, all forms	2	------
Columbium and tantalum, ore and concentrate	4	------
Copper, ore and concentrate	5,702	6,342
Gold, ore and concentrate troy ounces	16,236	1,157
Lead:		
Ore and concentrate	r 20,133	19,937
Metal, including alloys, all forms	r 1,129	351
Mercury 76-pound flasks	------	140
Silver, ore and concentrate thousand troy ounces	5,124	4,518
Tin:		
Ore and concentrate long tons	24,761	25,941
Metal, including alloys, all forms long tons	1,061	1,038
Tungsten, ore and concentrate [1]	2,633	3,251
Zinc, ore and concentrate	16,702	16,697
NONMETALS		
Asbestos	2	4
Gypsum and plaster	1,960	1,390
Salt and brines	13,151	4,784
Sulfur, elemental, all forms	58,457	49,312
MINERAL FUELS AND RELATED MATERIALS		
Gas, hydrocarbon million cubic feet	519	303
Petroleum, crude thousand 42-gallon barrels	2,027	10,521

r Revised.
[1] 60 percent WO_3 equivalent.

Source: Secretaría Técnica de Planificación, Dirección General de Estadística y Censos. Boletin Estadístico, 1967, No. 93.

Table 3.—Bolivia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum metal, including alloys, all forms	973	907
Copper metal, including alloys, all forms	367	412
Iron and steel, all forms	44,820	53,085
Lead metal, including alloys, all forms	15	8
Magnesium metal, including alloys, all forms	3	2
Nickel metal, including alloys, all forms	5	8
Tin metal, including alloys, all forms long tons	6	3
Zinc metal, including alloys, all forms	87	79
Other:		
Ashes and residues containing nonferrous metals	22	33
Metals, including alloys, all forms	11	7
NONMETALS		
Fertilizer materials	3,861	7,898
Other nonmetals, n.e.s.: Crude [1]	15,322	21,277
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	797	1,102
Petroleum refinery products:		
Gasoline	14,664	13,461
Kerosine	83	NA
Diesel oil	22	NA
Residual fuel oil	188	12
Other	10,941	7,804

NA Not available.
[1] Salt, sulfur, gypsum, lime, cement, earths, and stone not separately identified.

COMMODITY REVIEW

METALS

Tin.—Over $2 million worth of machinery was delivered from West Germany to the construction site of the tin smelter at Vinto, near Oruro. Klöckner Industrie Anlagen (Klöckner), of West Germany, is building the smelter as contractor for the Empresa Nacional de Fundiciones (ENAF), the entity established by the Bolivian Government to build and operate smelters. Buildings for the first stage of the complex are about 50 percent completed. In the first stage, smelter capacity is estimated at 7,500 tons of electrolytic tin and 700 tons of industrial tin alloys. Of the $9.3 million required for construction, about $1.6 million is available from a Tin Buffer Stock refund, about $3.6 million through credit by Klöckner, and the remaining $4.1 million must be provided by the Bolivian Government. In addition, an estimated $7.6 million working capital will be needed for efficient utilization of the installed smelter capacity. Of this amount, concentrate suppliers are expected, by accepting delayed payment, to furnish about $1.5 million, metal buyers, by advancing 80 percent of the purchased metal value, to provide over $2 million, which will leave another $4 million for the Government of Bolivia to finance from other sources.

Volatilization studies by the Institute of Mining and Metallurgy Research at the small ENAF smelter which COMIBOL rented in 1967 were encouraging enough for COMIBOL to rent the Pero smelter to conduct additional pilot-plant-scale

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studies in 1968. No results have been published.

COMIBOL selected Head Wrightson Process Engineering to carry out an engineering feasibility and design study for a plant to beneficiate low-grade concentrates. It is expected that increased recovery will be achieved by mechanical, chemical, and pyrometallurgical processes. High-grade tin concentrate, sulfuric acid, metallic silver, bismuth, and copper would be produced.

The Bolivian Government decided to permanently control all tin exports to guarantee compliance with the export quotas of the International Tin Council.

The International Tin Council held a meeting in La Paz in April. Roberto Querejazu Calvo, Bolivian Ambassador to the United Kingdom, was elected first vice president of the Council, representing producer countries. On the basis of 1967 production, Bolivia's voting power increased from 175 to 178.

COMIBOL plans to expand production into minerals other than tin, hoping to change the present predominance of tin (60 percent of mineral production) to only 40 percent. As a start, it plans to increase silver production at various mines known to contain high silver values in the ore. It is possible that the unprofitable San José tin mine at Oruro could be converted to silver production.

During 1968 the program for reducing excess personnel proceeded satisfactorily. Total employment was reduced during the year from about 22,500 to 20,900 or 7 percent.

Table 4.—Bolivia: Exports of tin by groups

(Long tons of contained tin)

Group	1966	1967	1968 p
Tin contained in concentrates:			
Corporación Minera de Bolivia (COMIBOL)	17,263	17,377	18,520
Medium-size mines	4,562	5,328	6,674
Banco Minero	2,935	3,234	3,751
Smelter products (refined metal and solder): ENAF and Fundición de Estaño de Oruro	1,062	1,038	-----
Total	25,822	26,977	28,945

p Preliminary.

NONMETALS

Cement.—Boliviana de Cemento, S.A., placed a $2 million order for equipment and services to expand its plant at Viacha from 100 to 200 tons per day. This is thought to be the highest cement plant in the world at 12,800 feet above sea level, and the equipment has to be designed to compensate for the altitude.

MINERAL FUELS

Petroleum and Natural Gas.—Production of crude petroleum increased about 3 percent, the additional output coming principally from the Tatarenda and Monteagudo fields of Yacimientos Petrolíferos Fiscales Bolivianos (YPFB), and the Caranda field of the Bolivian Gulf Oil Co. (BOGOC). YPFB increased production by over 14 percent in 1968 as increases from Tatarenda and Monteagudo more than offset a loss from the Camiri field. Crude petroleum production by BOGOC increased less than 1 percent in 1968, and its exports of crude petroleum through Arica, Chile, declined about 1 percent. This decline in exports was due to reduced production from the Colpa field, and also to the failure of two oil tankers to appear at the Arica terminal as scheduled.

There was a 7-percent increase in gas production in Bolivia, all coming from production by BOGOC. This firm produced 23.7 billion cubic feet of gas representing nearly three-fourths of all Bolivian production. At present, about 47 percent of the gas is flared, and most of the rest is used for injection to maintain field pressures. BOGOC is building a gas/oil separation facility at the Rio Grande field to be completed in 1969 with daily output capacity of about 12,000 barrels of oil and 170 million cubic feet of gas. The gas will be used for injection at 4,500 pounds per square inch and later for sale to Argentina. YPFB's production of gas declined about 1 billion cubic feet in 1968 from all fields. Most of the production was used for injection.

Gas production will become more important to Bolivia with the start of sales to Argentina. Over 1,000 billion cubic feet of gas will be sold under a 20-year contract signed on July 23 by BOGOC and YPFB for Bolivia and Gas del Estado for Argentina. The agreement calls for about 141 million cubic feet of gas per day for the

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first 7 years and about 159 million cubic feet per day for the balance of the contract. This contract should bring an estimated gross revenue of $13 million annually. A Delaware corporation owned jointly by BOGOC and YPFB will own a gas transmission line to be built between the Colpa-Caranda fields and the Bolivian border town of Pocitos. YPFB will manage the pipeline. The gas furnished by BOGOC will probably come from the Colpa and Rio Grande fields while the share contributed by YPFB will come from that produced in the Naranjillos and Monteagudo fields.

The two companies active in drilling, YPFB and BOGOC, drilled 436,422 feet of oil wells in Bolivia in 1968. This was about 60 percent more footage and 25 more wells than in 1967. There were 28 exploratory wells drilled (11 producing crude oil, 4 with gas, and 13 dry holes). Of the 38 development wells drilled, 28 brought in crude oil and 10 holes were dry. About 25 percent of the total footage for BOGOC and about 83 percent of YPFB's footage was exploratory.

BOGOC discovered a new gasfield north of Santa Cruz in the Bolpecor concession which, although not expected to be fully developed before 1971, may become the most important in Bolivia. BOGOC and the Bolivian Atlantic Co. (BAC), which had sole ownership of Bolpecor, signed an agreement in June 1965 by which BOGOC would acquire 50 percent of the Bolpecor concession if it completed two wells before November 1968. Approval for the change in ownership did not come from the Government of Bolivia until July 1968. BOGOC drilled the first well, Palacio No. 1, a dry hole with promising indications, by the end of September and Yapacani No. 1 by the end of October. About 200 feet of gas-bearing sands in the latter were evaluated, and large gas reserves were indicated. BOGOC had a geologic field party working in the Altiplano and a seismic crew working in eastern Bolivia during 1968.

YPFB's well, Monteagudo No. 7, which had blown out and caught fire in December 1967, was brought under control in June 1968, and the field was producing about 4,000 barrels per day by yearend. The new oil from the Monteagudo field plus the doubling of the production from the Tataranda field, starts YPFB crude production on an upward trend. These new discoveries counteract the loss from the Madrejones field (jointly owned with the Bolivian Oil Co.) which has had rapidly diminishing production in recent years and ceased production altogether beginning with 1968. YPFB is the only operator of oil refineries in Bolivia. The amount of crude oil treated by its seven refineries increased about 11 percent from 3.8 million barrels in 1967 to 4.2 million barrels in 1968. The principal refinery products are shown in table 1.

An absorption plant with the capacity to treat 15 million cubic feet of gas per day and produce 41 metric tons of liquefied petroleum gas (LPG) per day was completed by the Howe Baker Engineering Co. in Camiri in November 1968. Although consumption in Bolivia of LPG is only about 7 tons per day, negotiations were initiated to sell the rest to Argentina.

Bolivia's first petrochemical plant will be built in Santa Cruz according to an agreement reached with an international consortium from Mexico, Spain, and the Bahamas. The planned daily output of the principal products will be 90 tons of ammonia, 150 tons of nitric acid, and 200 tons of ammonium nitrate. The cost of the plant is estimated at $10.9 million, to be financed by the contractors, who will probably purchase most of the equipment in Western Europe.

Over 90 percent of the employees of BOGOC and its contractors in Bolivia (722 out of 789 total employees) are Bolivian nationals. YPFB probably employed between 4,500 and 5,000 people in 1968. The petroleum industry is the second largest employer in Bolivia.

Since June 1968, BOGOC no longer receives a depletion allowance, thus increasing the taxes paid to the Government of Bolivia in 1968 by $2.1 million to about $8 million. BOGOC also paid the Department of Santa Cruz about $2.5 million in royalties in 1968.

The most important legislation relating to petroleum in 1968 was contained in Supreme Decree No. 08341 of April 17, 1968, which nullified the Petroleum Code passed in 1955. A translation of the six articles of the decree follows:

> Article (1)—Starting on the above date no more petroleum concessions will be granted under the norms described in the Petroleum Code. The

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Dirección General de Petróleo will order the immediate return of all requests for concessions that were being transacted.

Article (2)—Petroleum concessions to foreign or national companies granted before April 17, 1968 will continue to be governed by the conditions under which the companies leased the concessions. However, this does not impede the G.O.B. from carrying on direct negotiations with the companies to improve the participation of the state.

Article (3)—A special commission is created composed of the representatives of all the agencies which form the National Petroleum and Petrochemical Council with the objective of studying the reforms which must be made in the new petroleum code. This study will be submitted to the Congress for its consideration.

Article (4)—While these reforms are being studied and previous to their approval by Congress, those national or foreign companies who want to invest in exploration, exploitation, distribution, or commercialization of hydrocarbons may do so through direct agreements with the Executive Powers of the G.O.B. but these companies must contemplate offering the G.O.B. conditions substantially better to the state than those offered by the Petroleum Code.

Article (5)—The Ministry of Economy is immediately authorized to seek in international credit institutions the financial resources necessary for the capitalization of Yacimientos Petrolíferos Fiscales Bolivianos (YPFB).

Article (6)—YPFB is authorized to dynamically explore for oil or gas directly or through operational joint venture contracts. The contracts should be approved by the National Petroleum Council.

Most of the companies who obtained exploration concessions in 1956 were unable to justify continued investment under the liberal Petroleum Code of 1955, so it is doubtful if many will desire to return under a new code which, by reducing profits, will lessen their chance of amortizing their investment.

Other legislation in 1968 simply ratified actions taken by YPFB or BOGOC in their regular business. For example, Supreme Resolutions 145,503 through 145,517 leased to YPFB various quantities of land in the departments of Oruro, Santa Cruz, La Paz, Cochabamba, and Chuquisaca for hydrocarbon exploration. The total concession area for YPFB was increased to 12,462,270 hectares compared with 11,245,208 hectares in 1967. BOGOC reduced its concession area to 1,441,688 hectares or 2.82 percent of the total held in Bolivia. Supreme Decree No. 08416 authorized YPFB to sign a contract with BOGOC to sell gas to Argentina.

Table 5.—Bolivia: Crude petroleum production by company and field

(Thousand 42-gallon barrels)

Company and field	1967	1968
Yacimientos Petrolíferos Fiscales Bolivianos:		
Camiri	1,930	1,496
Tatarenda	457	884
Monteagudo	------	438
El Toro	109	116
Bermejo	108	95
Camatindi	47	42
Buena Vista	24	16
El Tigre	4	16
Guairuy	46	12
Stapirenda	11	9
San Alberto	1	4
Total	2,737	3,128
Bolivian Oil Co.: Madrejones	15	------
Bolivian Gulf Oil Co.: Caranda-Colpa-Rio Grande	11,775	11,863
Grand total	14,527	14,991

Table 6.—Bolivia: Consumption[1] of petroleum refinery products

(Thousand 42-gallon barrels)

Product	1967	1968
Gasoline, aviation	[2] 112	NA
Gasoline, motor	1,358	1,505
Kerosine	590	652
Diesel oil	369	439
Fuel oil	724	759
Lubricants	38	36

NA Not available.

[1] Figures refer to actual civilian and military consumption through sales to consumer, and including YPFB consumption.

[2] Imports.

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The Mineral Industry of Brazil

By F. W. Wessel [1]

The mineral industry of Brazil had a third consecutive year of generally active and expanding production. Major gains were established in output of iron and steel, aluminum, manganese and tungsten ores, beryl, pyrochlore, asbestos, cement, and crude oil. Modest increases were recorded in iron ore, nickel, gold, ilmenite, and coal. One of Brazil's two zinc smelters overcame technical difficulties and began quantity production. Salt, a weak point in 1967, was produced in 1968 in quantity sufficient to supply national requirements.

Gross national product (GNP) in 1967 (the most recent year for which data are available) was US$18.2 billion.[2] The value of mineral production for that year was $432 million of which almost exactly $100 million was contributed by petroleum. In percent, all minerals represent 2.37 of the GNP, of which petroleum alone accounts for 0.55. Similar percentages for 1966 were 2.13 and 0.42, respectively. Sufficient data were not available to develop figures for 1968, but the GNP-mineral industry proportion will probably remain fairly constant.

Early in the year, Decree-Law 348 gave to the Conselho de Segurança Nacional (National Security Council) the responsibility to study problems affecting national security. Specifically included are the fields of mineral resource development, steel metallurgy, nuclear energy, and petroleum.

Decree 62837, issued in June, transferred to the Naval Ministry the authority to approve scientific missions in Brazil's offshore waters.

At midyear the Roraima project was inaugurated. A cartographic base will be established after aerophotography; the preparation of basic maps will follow. Geochemical prospecting will be applied to promising areas of the Territory of Roraima.

The Government obtained from the World Bank a loan of $26 million, to finance 268 miles of highway construction in Rio Grande do Sul, Santa Catarina, Paraná, and Minas Gerais.

The first stage of a 160-megawatt thermal powerplant at Santa Cruz, Guanabara, was inaugurated in May.

PRODUCTION

The year 1968 saw further increases in mineral production in most sectors of the industry. Iron ore and manganese ore, the large export items, gained 9 and 50 percent, respectively. Aluminum ingot production was 40 percent greater than in 1967, and beryl, pyrochlore, and ilmenite showed substantial gains. Among the nonmetals, cement production was 14 percent greater; salt production showed the effect of favorable weather conditions, and asbestos output substantially increased. Production of barite and phosphatic fertilizers declined. Crude oil production gained 9.5 percent, and output of marketable coal rose 3 percent.

Production of both steel ingot and semimanufactures was 20 percent greater than in the previous year. Major factors in the demand were heavy construction and the automotive industry; the situation was materially aided by the Government's liberalization of pricing policy. Government-owned steel plants produced 57 percent of Brazil's iron and steel in 1968.

[1] Physical scientist, Division of International Activities.

[2] Converted at the yearend exchange rate of NCr$3.22=US$1.

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Table 1.—Brazil: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, gross weight	181,650	155,968	r 249,931	r 302,853	e 306,000
Alumina	50,921	r 55,335	68,254	r 86,943	e 83,000
Metal, primary	26,640	30,407	26,886	r 29,701	e 41,470
Antimony, metal [2]	NA	164	112	59	102
Arsenic, white	188	256	r 320	222	312
Beryl concentrate, gross weight [3]	1,421	1,113	4 796	1,310	2,078
Chromite, gross weight [e]	5 9,440	r 32,000	r 24,200	r 15,000	15,500
Columbium and tantalum, ore and concentrate, gross weight:					
Columbite [3]	11	40	59	r 102	63
Tantalite [3]	82	165	160	r 205	272
Pyrochlore	323	1,196	4,775	4,626	4,999
Copper:					
Mine output, metal content [e]	2,000	r 2,275	2,150	r 2,150	NA
Metal, blister [e 6]	r 3,300	r 3,650	r 3,500	r 3,500	NA
Gold, metal [7] thousand troy ounces	143	155	168	172	e 188
Iron and steel:					
Iron ore and concentrate thousand tons	16,962	r 20,754	23,254	r 22,298	e 24,200
Pig iron, excluding ferroalloys do.	r 2,449	r 2,341	r 2,925	r 3,057	3,372
Ferroalloys:					
Ferromanganese	19,063	26,390	31,314	31,308	8 12,370
Ferrosilicon	13,688	10,041	13,552	15,625	8 6,897
Ferrochromium	1,451	2,025	2,995	1,665	9 3,642
Ferrocolumbium	18	276	459	528	1,144
Ferronickel	3,293	3,704	3,791	4,098	4,119
Silicomanganese	5,689	9,114	6,009	4,726	8 4,697
Other	115	29	172	118	NA
Steel, excluding castings thousand tons	3,016	2,983	r 3,782	r 3,696	4,436
Steel, semimanufactures do.	2,422	2,161	r 2,699	r 2,848	3,425
Lead:					
Mine output, metal content	e 14,700	e 22,500	22,637	23,422	27,080
Metal, primary	13,079	9,665	17,177	17,284	16,167
Manganese, ore and concentrate (marketable) gross weight thousand tons	973	985	1,022	941	1,426
Nickel:					
Mine output, metal content	1,290	1,303	1,238	1,224	1,240
Ferroalloy, nickel content	r 1,103	1,114	r 1,070	1,071	1,076
Rare-earth metals, monazite concentrate, gross weight	665	597	746	1,079	1,691
Silver, metal thousand troy ounces	314	228	222	225	464
Tin:					
Mine output, metal content [e] long tons	790	1,810	1,855	1,600	2,240
Metal, primary do.	1,731	1,753	1,545	1,415	1,251
Titanium:					
Ilmenite concentrate, gross weight	8,271	r 9,764	13,535	14,967	17,881
Rutile concentrate, gross weight	286	r 315	34	284	114
Tungsten, mine output, metal (W) content [10 e]	182	182	224	289	435
Zinc, metal	---	r 49	1,344	1,792	e 4,800
Zirconium, concentrate, gross weight:					
Zircon	1,756	1,156	1,954	2,162	2,312
Other	516	493	e 495	e 500	485
NONMETALS					
Abrasives, natural, n.e.s., emery and corundum	NA	NA	r 1,683	r 1,820	2,110
Asbestos [11]	1,300	1,092	1,651	1,356	4,360
Barite [12]	33,537	64,360	5 40,228	5 54,497	48,066
Cement, hydraulic thousand tons	5,564	5,577	6,046	6,405	7,281
Diamond: [13 e]					
Gem thousand carats	175	175	150	160	160
Industrial do.	175	175	150	160	160
Total do.	350	350	300	320	320
Fertilizer materials, crude, phosphates: [14]					
Apatite	195,077	191,836	295,215	129,606	148,898
Phosphate rock	51,142	86,908	83,150	83,772	3,480
Fertilizer materials, manufactured, nitrogenous, nitrogen content	22,503	e 43,000	e 28,400	e 28,500	34,733
Graphite, all grades	e 1,150	1,172	1,277	2,896	2,260
Gypsum and anhydrite, crude	84,405	72,538	80,223	71,450	NA

See footnotes at end of table.

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Table 1.—Brazil: Production of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS—Continued					
Lime—thousand tons	1,488	1,220	r 1,270	1,355	NA
Lithium minerals [2]	---	6,815	e 100	r 6,169	---
Magnesite	93,740	124,642	127,071	109,258	NA
Mica, all grades	[3] 1,741	[3] 2,268	1,018	e 1,100	NA
Precious and semiprecious stone, except diamond:					
Agate, rough [3]	338	446	596	471	571
Other stones, uncut [3]	405	304	464	340	286
Other stones, cut [3]—kilograms	10	189	606	161	197
Cutting [3]	270	458	246	270	205
Quartz, crystal, all grades [3]	1,685	2,119	3,254	3,407	e 2,400
Salt, marine—thousand tons	754	1,200	r 1,441	1,040	1,536
Stone, sand and gravel, n.e.s.:					
Dimension stone, marble	50,952	46,500	41,228	41,882	NA
Crushed and broken, dolomite [15]	330,387	228,209	200,530	224,972	NA
Sulfur, elemental, byproduct	NA	5,022	5,918	6,210	6,925
Talc, soapstone, pyrophyllite	48,115	57,648	e 59,000	NA	NA
Vermiculite	NA	NA	400	218	2,471
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	23,904	22,580	29,446	30,700	45,000
Coal, marketable, all grades—thousand tons	1,782	1,985	2,144	2,295	2,364
Coke:					
High-temperature—do	912	909	1,240	r 1,318	1,407
Gas-house—do	e 280	219	224	205	198
Gas:					
Manufactured, all types—million cubic feet	NA	12,633	12,828	13,118	12,718
Natural, gross withdrawal—do	18,777	24,125	r 27,848	30,888	34,726
Petroleum:					
Crude oil—thousand 42-gallon barrels	33,310	34,342	42,446	r 54,622	59,816
Refinery products:					
Motor gasoline—do	36,536	36,555	42,461	43,019	46,842
Naphtha [16]—do	NA	NA	NA	[17] 30	381
Kerosine—do	4,540	4,123	4,635	4,762	5,335
Jet fuel—do	6	---	145	1,266	2,402
Distillate fuel oil—do	23,910	22,984	28,996	e 31,000	35,134
Residual fuel oil—do	39,290	35,314	38,886	e 41,100	46,601
Liquefied petroleum gas—do	5,417	6,593	7,230	([18])	7,591
Lubricants—do	3	35	---	---	36
Asphalt and bitumen, refinery—thousand 42-gallon barrels	1,288	1,817	2,467	([18])	4,167
Other salable products, fluid—thousand 42-gallon barrels	1,302	1,219	1,751	11,232	2,061

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Brazil also produces molybdenite, fluorspar, feldspar, clay and shale, stone, n.e.s., sand and gravel but production data are not available.

[2] Includes small quantity of metal contained in antimonial lead.

[3] Exports.

[4] U.S. imports.

[5] Production of Bolivia only.

[6] Includes secondary metal.

[7] Officially reported and estimated. Much placer gold produced eludes statistical coverage.

[8] Production of Minas Gerais only.

[9] Total for 2 producers only.

[10] In standard terms of reference, the estimated WO_3 content in metric tons is as follows: 1964, 230; 1965, 229; 1966, 282; 1967, 864; and 1968, 549.

[11] Production of State of Bahia only, 1964, 1965, 1966; production from Bahia and Goias, 1967–68. Asbestos is produced in 3 other states, but data are not available.

[12] Includes both ore and concentrate.

[13] By far the larger part of Brazil's diamond production is not reported statistically, hence the estimates tabulated are based only on very general market information.

[14] Data for 1964, 1965, and 1966, taken from various editions of the Anuário Estadístico do Brasil; data for 1967 and 1968 furnished by the Sao Paulo Sindicato da Industria de Adubos e Colas.

[15] Limestone and other varieties are produced, but data are not available. Limestone used to produce cement and lime is estimated at 10 to 12 million tons annually during the tabulated period.

[16] Included in "Motor gasoline" figure, 1964–66.

[17] PETROBRAS only.

[18] Included in "Other".

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TRADE

Brazil's overall trade balance in 1968 showed $1,881 million in exports, and $2,132 million in imports, continuing and widening the negative balance of 1967, as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	191	1,595
1966	164	1,741
1967	183	1,652
Imports:		
1965	407	1,096
1966	515	1,497
1967	505	1,670

Exports of mineral commodities increased 11½ percent in 1967, accounting for 11 percent of total exports. While the value of manganese ore exports declined by almost half, exports of steel semimanufactures, cast iron, and ferroalloys more than made up the loss.

The excess of mineral commodity imports over exports in 1967 was $322 million, a decrease of 8 percent from the 1966 figure of $351 million.

The value of mineral commodity imports in 1967 was 2 percent less than in 1966. Imports of crude petroleum and petroleum refinery products—principally lubricants, gasoline, and liquefied petroleum (LP) gases—increased 5 and 16 percent, respectively, imports of fertilizer materials were up 7 percent, and sulfur imports gained 30 percent. Imports of major metals—steel semimanufactures, aluminum, copper, and zinc—were down 27 percent, coal imports declined 23 percent, and caustic soda 22 percent.

Experience with the new (June 1966) Brazilian trade regulations is now sufficient to indicate their favorable effect at least upon exports. Export licenses are no longer needed for many commodities although the requirement remains in force for copper, lead, zinc, precious metals, and petroleum products.

A decree of June 1968 gave the Customs Policy Council authority to reduce or waive import duties on, among other items, capital goods for installation in basic industrial plants.

Import duties were increased on germanium and selenium diodes (15 to 45 percent), zinc powder and granules (30 to 40 percent), and caustic soda (32 to 50 percent, but reduced to 2 percent if importer shows domestic purchase of 0.75 ton for each ton imported).

Investment of $125 million in port modernization was officially announced late in the year. A program, to be completed at the end of 1971, will extend facilities at Tubarão. A port will be built at Sepetiba Bay, to which all of the Paraopeba iron ores may be diverted. Work is nearing completion on the oil terminal at São Sebastião and the pipeline connections to the refinery at Cubatão. Special installations at Santos to handle steel exports from Cia. Siderúrgica Paulista also are substantially complete.

Table 2.—Brazil: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite	2,270	2,230	Uruguay 1,600; Argentina 630.
Oxide	15	1	All to Netherlands.
Metal:			
Unwrought	842	184	All to Argentina.
Semimanufactures	4	76	Mainly to Paraguay.
Beryl ore and concentrate	706	1,810	Mainly to United States.
Chromium, ore and concentrate	50	45	All to Argentina.
Columbium and tantalum, ore and concentrate:			
Columbite and tantalite	219	306	Mainly to United States.
Pyrochlore [1]	3,870	2,725	United States 1,430; United Kingdom 480.

See footnote at end of table.

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Table 2.—Brazil: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Iron and steel:			
Ore and concentrate--thousand tons--	12,910	14,279	West Germany 4,550; Japan 2,868.
Metal:			
Scrap	16,480	8,122	Mainly to Japan.
Pig iron	2,000	263,731	Do.
Ferroalloys:			
Ferromanganese	776	310	Argentina 200.
Ferrosilicon	100	105	Mainly to Uruguay.
Ferrochrome	38	60	All to Argentina.
Ferrocolumbium	408	481	Mainly to United States.
Ferronickel	756	2,678	Japan 1,545; Mexico 546.
Steel:			
Primary forms, ingot	256	--	
Semimanufactures	143,280	849,097	United States 160,226; Argentina 148,763.
Lead, ore and concentrate	5,000	--	
Manganese, ore and concentrate	956,558	542,017	United States 266,380; France 69,208.
Mercury--76-pound flasks--	450	--	
Rare-earth metals, ferro- kilograms-- cerium.	4,120	3,564	Mainly to Argentina.
Tungsten:			
Ore and concentrate	340	420	Belgium-Luxembourg 185; France 115; Bulgaria 60.
Metal, including alloys, kilograms-- all forms.	566	5,721	Mainly to United States.
Zinc, ore and concentrate	324	212	Belgium-Luxembourg 112; Netherlands 100.
Zirconium and hafnium, ore and concentrate.	25	86	All to Argentina.
Other [2]	7,787	581	Mainly to France.
NONMETALS			
Abrasives,[3] emery and corundum	581	897	Mainly to Argentina.
Asbestos	--	15	All to Bolivia.
Barite	48,768	49,068	Trinidad and Tobago 42,922; Venezuela 6,146.
Cement	3,689	14,269	Mainly to Bolivia.
Clays and clay products:			
Crude clays, n.e.s., kaolin	700	960	All to Uruguay.
Products, refractory	355	923	Mainly to Paraguay.
Diamonds:			
Gem, uncut and cut but unset--carats--	13,385	15,145	Netherlands 9,660; United States 3,400.
Industrial--do--	22,130	11,970	United States 5,710; Netherlands 4,475.
Fluorspar	25	--	
Graphite, natural	9	8	Mainly to Argentina.
Magnesite	4,653	4,700	Hungary 2,000; Argentina 1,455; France 800.
Mica, all forms	1,897	1,045	Mainly to United States.
Precious and semiprecious kilograms-- stone.[3]	1,070,305	610,770	Japan 208,409; West Germany 161,286; United States 112,888.
Stone, sand and gravel, dimension stone:			
Crude and partly worked:			
Calcareous	813	866	Mainly to Italy.
Other	8,433	8,495	Japan 3,234; Italy 3,160; United States 1,010.
Worked	138	82	United States 53; Mexico 19.
Talc, soapstone, and pyrophyllite	501	225	Mainly to Colombia.
Other nonmetals, n.e.s.:			
Agate, rough--kilograms--	596,470	471,180	Japan 166,600; West Germany 122,201; United States 107,351.
Lithium minerals:			
Spodumene	100	50	All to United Kingdom.
Other	--	6,119	All to Japan.
Quartz crystal:			
Electronic and optical grade	162	112	United States 64; Japan 22.
Other	3,092	3,810	West Germany 778; Japan 668; United Kingdom 644.
Slag, not metal-bearing	--	5,624	Mainly to Japan.
Other [2]	85	38	Colombia 15; Italy 7; Argentina 7.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	18	50	All to Uruguay.
Petroleum, thousand 42-gallon barrels-- refinery products: Residual fuel oil.	--	620	All to United States.

[1] Brazil includes pyrochlore under trade classification 237.79: Minérios Metálicos, N.E. (metalliferous ores, not specified). Starting in 1968 most, if not all, material exported under this category was pyrochlore concentrate. Quantities shown in this table have not been completely verified and may include small amounts of other commodities.

[2] Includes material not identified by commodity in source and commodities not listed separately in table.

[3] Excludes diamond and rough agate.

Source: Servico de Estatística Economica e Financeira, Comércio Exterior, 1966 and 1967.

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Table 3.—Brazil: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Oxide (alumina)	r 584	463	Mainly from United States.
Metal:			
Unwrought	39,540	28,014	United States 13,276; Canada 6,552; U.S.S.R. 3,340.
Semimanufactures	1,364	1,087	France 433; West Germany 180; United States 143.
Antimony:			
Ore and concentrate	295	236	Bolivia 119; Republic of South Africa 60
Metal, including alloys, all forms	237	70	Mainly from Czechoslovakia.
Arsenic, trioxide and regulus	r 268	637	France 248; Sweden 232; West Germany 88.
Bismuth, metal, including alloys, all forms. kilograms	9,781	9,685	Mainly from Mexico.
Cadmium, metal, including alloys, all forms. do	56,576	46,216	Do.
Chromium:			
Chromite	2,087	6,193	Mainly from Panama. [1]
Metal, including alloys, all forms	6	22	Sweden 13; Japan 6.
Cobalt:			
Oxide and hydroxide	47	36	United Kingdom 22; Belgium-Luxembourg 14.
Metal, including alloys, all forms	93	74	Mainly from Belgium-Luxembourg.
Columbium and tantalum, metal, all forms, tantalum.	76	4	All from United States.
Copper:			
Copper sulfate	3,165	2,002	Mexico 698; United Kingdom 576; Peru 357; Chile 243.
Metal:			
Scrap	235	39	Mainly from United States.
Unwrought:			
Refined, unalloyed	43,196	36,437	West Germany 7,982; United States 7,631; Chile 6,625; Zambia 6,261.
Alloys	7	(2)	Mainly from United States.
Semimanufactures	494	482	West Germany 244; United States 164.
Gold, metal, unworked or partly worked. troy ounces	514	21,606	France 7,588; United Kingdom 6,527; Canada 5,144.
Iron and steel, metal:			
Scrap	72	500	All from United States.
Sponge iron, powder, and shot	914	807	Mainly from United States.
Ferroalloys	2,751	1,988	United States 321; Southern Rhodesia 307; Chile 300.
Semimanufactures	r 310,784	332,885	West Germany 69,879; Poland 69,628; Japan 54,281.
Lead:			
Oxides	276	596	Mainly from Mexico.
Metal, including alloys, all forms	5,554	6,518	Mexico 4,692; United States 1,008.
Magnesium metal, including alloys, all forms.	2,817	1,985	Norway 1,025; United States 960.
Manganese:			
Ore and concentrate	--------	287	Mainly from United States.
Oxide	686	760	Mainly from Japan.
Metal	39	56	Japan 30; Republic of South Africa 15.
Mercury. 76-pound flasks	1,616	717	Mainly from Mexico.
Molybdenum:			
Ore and concentrate	17	44	Mainly from Canada.
Metal, including alloys, all forms	12	10	Netherlands 5; United States 4.
Nickel, metal:			
Scrap	27	84	All from United States.
Unwrought	475	387	Mainly from United States.
Semimanufactures	404	453	United States 196; West Germany 124; France 67.
Platinum-group metals, including alloys, all forms:			
Platinum [3]. troy ounces	10,674	1,318	Mainly from United States.
Other. do	965	1,993	United States 1,029; West Germany 836.
Radium. milligrams	--------	9	All from United States.
Selenium, elemental. kilograms	7,764	3,715	Mainly from Canada.
Silicon, metal	665	386	Sweden 155; Norway 125.
Silver, metal, including alloys, all forms. troy ounces	970,662	907,710	Peru 271,802; Argentina 249,071; Mexico 245,792.
Sodium, metal. kilograms	7,335	6,527	Mainly from West Germany.
Tellurium, elemental. do	51	192	Mainly from United States.

See footnotes at end of table.

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Table 3.—Brazil: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Tin:			
Ore and concentrates—long tons	233	1	All from Argentina.
Oxides—do	55	51	United Kingdom 29; West Germany 22.
Metal, including alloys, all forms.—do	4	8	United States 3; Uruguay 3.
Titanium:			
Ore and concentrate, rutile	446	1,212	Mainly from Australia.
Oxides	9,920	9,468	United Kingdom 5,306; West Germany 1,403.
Tungsten:			
Ore and concentrates, wolframite	10	10	All from Peru.
Metal, including alloys, all forms.—kilograms	5,915	5,822	Netherlands, 2,266; United States 1,875; West Germany 1,556.
Uranium and thorium, isotopes and compounds.—value	$846,827	$183,363	United States $64,887; Portugal $63,860; Canada $28,156.
Zinc:			
Oxide	r 60	38	West Germany 21; United States 10.
Metal:			
Unwrought	41,435	36,113	Peru 13, 972; Mexico 10,722.
Semimanufactures	210	338	Mainly from Belgium-Luxembourg.
Zirconium and hafnium, ore and concentrate.	1,016	2,117	All from Australia.
Other [4]	8	2	Mainly from United States.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, tripoli, etc	494	718	Mainly from Italy.
Grinding flints	210	746	Mainly from France.
Asbestos	18,948	17,504	Mainly from Canada.
Barite	46	7	All from United States.
Boron materials:			
Crude natural borates	1,180	1,957	Netherlands 1,007; United States 900.
Oxide and acid	925	981	Mainly from United States.
Bromine—kilograms	13,701	5,347	Mainly from Israel.
Cement	92,921	124,826	Colombia 43,734; Uruguay 42,660; West Germany 17,296.
Chalk, natural	2,404	1,839	Mainly from United States.
Clays and clay products:			
Crude clays, n.e.s.:			
Bentonite	8,618	5,497	United States 3,305; Argentina 2,190.
Fire clay	82	37	United States 25; West Germany 12.
Kaolin	480	919	United States 563; United Kingdom 306.
Other	439	356	Mainly from United States.
Products, refractory	5,890	6,915	Do.
Cryolite, natural	1,093	1,139	Mainly from Greenland.
Diatomite and other infusorial earths	2,025	1,387	Mainly from United States.
Feldspar	--------	5	Switzerland 3; Uruguay 2.
Fertilizer materials:			
Crude:			
Nitrogenous, nitrates, natural	46,789	36,877	All from Chile.
Phosphatic, phosphate rock	112,199	225,344	Mainly from United States.
Manufactured:			
Nitrogenous	261,842	350,272	West Germany 116,117; Italy 70,415; Netherlands 52,087; United States 46,764.
Phosphatic:			
Thomas slag	6,153	6,991	Mainly from Belgium-Luxembourg.
Other	62,257	103,598	Mainly from United States.
Potassic	152,691	226,890	France 43,135; United States 42,585; Israel 41,843; West Germany 36,028.
Other, including mixed	199	267	West Germany 141; Japan 125.
Fluorspar	--------	26	Switzerland 18; Uruguay 8.[1]
Graphite, natural	126	168	United States 128; West Germany 30.
Gypsum and plasters	2,046	1,244	Mainly from Bolivia.
Iodine—kilograms	22,391	18,911	Chile 9,500; Argentina 4,600; Belgium-Luxembourg 2,362.
Mica:			
Crude, including splittings and waste.—do	1,794	100	All from United States.
Worked—do	22,490	22,287	Switzerland 9,825; United States 7,977; France 4,446.
Phosphorus, elemental	180	86	Japan 28; United Kingdom 28.
Pigments, mineral, including processed iron oxides.	14	8	Mainly from West Germany.
Pyrite, gross weight	--------	4	All from United States.

See footnotes at end of table.

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Table 3.—Brazil: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Salt	197,268	49,098	Bahamas 25,000; West Germany 10,300; United States 10,142.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	149,896	127,848	United States 54,653; France 16,515; United Kingdom 15,476.
Caustic potash	1,410	991	United States 544; France 172; Italy 136.
Soda ash	2	2,001	Poland 1,000; United Kingdom 1,000.
Sodium sulfate	14,284	14,691	Mexico 8,247; East Germany 6,109.
Stone, sand and gravel:			
Dimension stone, marble	29	85	Mainly from Italy.
Dolomite	56	112	Do.
Sulfur, elemental, all forms	167,512	205,003	Mainly from United States.
Talc, soapstone, and pyrophyllite	-------	31	Mainly from Norway.
Other [4]	8	8	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	4,782	5,356	Argentina 2,119; United States 1,439; West Germany 595.
Coal, all grades, including briquets	1,744,425	1,537,475	Mainly from United States.
Coke and semicoke	57,840	43,501	Mainly from West Germany.
Gas, hydro- thousand 42-gallon barrels	2,861	3,291	Mainly from Venezuela.
carbon, natural gas liquids (LPG).			
Petroleum:			
Crude—thousand 42-gallon barrels	83,869	78,224	Saudi Arabia 31,547; Venezuela 16,252; Iraq 13,184.
Refinery products:			
Gasoline—do	r 1,181	1,682	Mainly from Netherlands Antilles.
Kerosine—do	11	13	All from United States.
Jet fuel—do	2,104	1,737	Mainly from Netherlands Antilles.
Distillate fuel oil—do	-------	147	All from Venezuela.
Residual fuel oil—do	118	848	All from Netherlands Antilles.
Lubricants—do	2,086	2,067	Mainly from United States.
Mineral jelly and wax	22,582	24,254	United States 10,239; Rumania 5,865; East Germany 4,830; Japan 2,685.
Other:			
Petroleum coke	14,204	22,743	Mainly from United States.
Bitumen and other residues	303	107	United Kingdom 68; Japan 16; France 15.
Mineral tar and other hydrocarbon-based chemicals.	38,930	52,054	Mainly from Venezuela.

r Revised.
[1] As reported. Possibly transshipment.
[2] Less than ½ unit.
[3] Excludes jewelry and other ornamental items.
[4] Includes some material not identified by commodity in source, and commodities not listed separately in table.

Source: Servico de Estatistica Economica e Financeira, Comércio Exterior, V. 1.

COMMODITY REVIEW

METALS

Aluminum.—Production of raw aluminum continued to increase; output was 40 percent greater than in 1967. Alumínio Minas Gerais, S.A. (ALUMINAS), an affiliate of Alcan Aluminium, Ltd., produced 22,120 tons at its smelter at Saramenha. Continued expansion was expected to provide annual capacity of 27,000 tons by the end of 1969, and an additional 3,000 tons during 1970. The company was planning to erect a second smelter at the Aratú Industrial Center, near Salvador, Bahia, of an initial 11,000-ton capacity; alumina production at Saramenha was to be increased to 90,000 tons annually to provide feed for both plants.

Production at the Sorocaba, São Paulo plant of Cia. Brasileira de Alumínio came to 19,350 tons, 14 percent over 1967 output. Capacity was expanded during the year to over 30,000 tons, but power shortages continued to hamper operations.

Construction continued throughout the year on the refinery and smelter of the Cia. Mineira de Alumínio (ALCOMINAS) at Poços de Caldas. Planned annual capacity is 50,000 tons of alumina and 27,000 tons of metal. Aluminum Company of America

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holds 50 percent of the stock, The Hanna Mining Co. 34 percent, and the State of Minas Gerais the remainder. Financing was completed in January.

Iron Ore.—Brazilian production and exports both increased in 1968, again setting records. Output was up 9 percent. Exports, at 15.4 million tons, increased 8 percent; the value of iron ore exported, $104.45 million, increased only 2 percent due to a larger proportion of lower priced fines in the export mix.

Cia. Vale do Rio Doce (CVRD), 86 percent government-owned, again was the major producer, mining an estimated 12,765,000 tons (12,402,665 tons in 1967). The Cia. Siderúrgica Nacional (CSN) produced 1.7 million tons of immediately usable ore while stockpiling a large quantity of fines for future use.

Tonnages exported through Vitória-Tubarão and Rio de Janeiro in 1968 were 12,758,101 and 2,680,780, respectively, CVRD accounting for 77 percent of the total. Exports were distributed as follows, in percent:

Western Europe	67.0
Japan	16.3
United States and Canada	10.2
Argentina and Mexico	3.4
Eastern Europe	3.1

Iron ore exports from each of the two ports during recent years are tabulated below, in million metric tons:

Year	Vitória-Tubarao	Rio de Janeiro
1964	7.82	1.81
1965	10.01	2.58
1966 [1]	10.10	2.88
1967	11.66	2.55
1968	12.76	2.68

[1] Tubarao port facilities inaugurated April 1.

CVRD's pelletizing plant at Tubarão was nearing completion at yearend. The plant was built by Voest, an Austrian Government-owned corporation, which also expects to provide a second such plant in the near future. This construction is part of a 3-year modernization and expansion program which also includes opening of additional mines, railway improvement, and increasing the Tubarão port capacity.

Progress in constructing the Fabrica-Costa Lacerda rail link continued, in spite of extremely difficult terrain.

CVRD offered a group of seven Japanese steelmakers a third contract for iron ore, the contract calling for delivery of 22.4 million tons of ore over the period 1970–77, at f.o.b. prices of $5.50 per ton for fines and $8.20 for lump.

Cia. Meridional de Mineração, a subsidiary of United States Steel Corp., has been granted authorizations to prospect certain portions of the area in which the company's geologists discovered iron ore last year. The deposits are in the State of Pará, south and east of the Itacaiunas River (a tributary of the Tocantins River), 100 to 125 miles southwest of Marabá, and 300 miles from the port of Belém. Detailed exploration was expected to be completed by the end of 1971. If the deposits are then to be developed, the necessary investment was estimated at $300 million.

To exploit the deposits, an agreement between CVRD and Meridional has been reached. The agreement provides that CVRD will hold 51 percent of the stock, Meridional the remainder. If development is undertaken, Meridional will purchase its minority holding with the $300 million mentioned above, with which Meridional will build roads, ports, and other supporting facilities. The agreement has not yet been made official by Government Decree.

In a policy statement issued in April, the Brazilian Government signified its approval of the proposals submitted by Cia. Auxiliar de Empresas de Mineração (CAEMI) for development of additional iron ore in the Paraopeba Valley and the construction of a marine terminal on Sepetiba Bay, near Rio de Janeiro and to come under the authority of that port. The CAEMI subsidiary, Minerações Brasileiras Reunidas (MBR), partly owned by The Hanna Mining Co., is the designated operating entity. The final terms of the CAEMI-Hanna merger agreement are still under discussion.

MBR expects to invest $100 million in the project, and to begin shipment at the rate of 6.3 million tons per year, about two-thirds of which will be taken by Japanese consumers.

In July a Government Decree authorized Cia. de Mineração Novalimense, a Hanna subsidiary, to mine iron ore in the municipality of Nova Lima, Minas Gerais. Included therein is the high-grade Aguas Claras deposit. Novalimense's concession to Aguas Claras had been cancelled in 1962, which action was successfully contested by Hanna in the courts.

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Ferteco, S.A., and affiliated companies are modernizing and expanding their mining operations in preparation for the opening of the Fabrica-Costa Lacerda rail link by CVRD.

Iron and Steel.—Production of pig iron and ingot steel in 1968 was, respectively, 10 and 20 percent above 1967 levels, partly because of low consumer inventories at the beginning of the year. Exports of semimanufactured steel increased 144 percent in 1967, but in 1968 declined 12 percent to 307,000 tons. Only a little ingot was exported in 1966, and none at all in 1967. Imports increased 7 percent in 1967, and a further 4 percent in 1968, reaching 346,000 tons.

A consultative and advisory council (Conselho Consultivo da Indústria Siderúrgica) was organized, the effect of whose operations will be to coordinate the Government-controlled sector of the steel industry. Reportedly a holding company will be formed to include Cia. Siderúrgica Nacional (CSN), Usinas Siderúrgicas de Minas Gerais (USIMINAS), Cia. Siderúrgica Paulista (COSIPA), and Ferro e Aço de Vitória.

Presidential approval has been given to plans for expansion of ingot capacities as follows: CSN, 250,000 tons, USIMINAS, 775,000 tons, COSIPA, 385,000 tons, and other plants, 460,000 tons. Rationalization of pricing policy will also be undertaken. The cost of this expansion was estimated at $598 million; annual savings of $135 million in foreign exchange were expected. The expanding construction and automotive industries were seen as principal consumers. In addition to the plant expansions listed above, some of which were underway at the yearend, Cia. Siderúrgica Belgo-Mineira was improving its blast-furnace operations, had completed construction of a 300,000-ton bar mill, and was taking other measures for improvement of operations. A 100,000-ton Linz-Donawitz plant and a 30,000-ton continuous casting facility were under construction for Siderúrgica Barra Mansa. Aços Villares, S.A., has ordered vacuum-melting equipment to expand its special steels production to 90,000 tons by mid-1969. A 60,000-ton steel plant is projected for Aços Finos Piratini (not under construction, as reported in 1967). This plant is expected to meet demand of the southern States and to have some export capacity.

Nickel.—Morro de Niquel has obtained a $2.5 million loan from the Japanese Sumitomo group for expanding its production capacity from 2 to 6 million pounds of nickel, contained in ferronickel, at its Libertade plant.

Four Japanese companies have sent a team to survey nickel ore resources in the Ipanema district of Minas Gerais.

Tungsten.—The Brejui mine at Currais Novos, Rio Grande do Norte, remained Brazil's only large tungsten operation, continuing to produce scheelite concentrate of 70 percent WO_3 grade throughout 1968. However, several groups are seeking to rehabilitate old properties or to develop new ones. BRASIMET Comercia e Industria, S.A., was refitting an old mine, the Barra Verde, apparently intending to reopen shortly.

A team of Brazilian and United States geologists and engineers continued to explore the district for tungsten.

Uranium.—Implementing the 1967 agreement with France, technicians from that country began, early in the year, to prospect for uranium in the sedimentary basin of Piauí and Maranhão.

Uranium was reported in the bituminous shales of the Paraíba Valley in quantities of 0.1 to 0.2 percent. Uranium and monazite were also found in the Serido area of Rio Grande do Norte. Late in the year, discovery of an orebody of 500,000 tons of 0.3 percent uranium in Minas Gerais was announced.

Zinc.—The electrolytic zinc plant of Cia. Mercantil e Industrial INGA produced at about two-thirds capacity during 1968, using a calamine ore, containing about 25 percent zinc, mined at Vazante, Minas Gerais. A similar operation at Tres Marias, Minas Gerais, is still under construction. Zinc imports increased 19 percent to 43,000 metric tons in 1968.

NONMETALS

Asbestos.—The S.A. Mineração de Amianto reported transfer of its principal operations out of Bahia to Cana Brava, Goiás.

Cement.—Brazil's cement production enjoyed another record year. Output was 14 percent greater than in 1967, and the

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industry operated at 95 percent of its 7.66-million-ton capacity. The States of Minas Gerais and São Paulo each produced about 30 percent of the total. Eight plants were reported under construction at yearend—one each in Rio de Janeiro, São Paulo, and Minas Gerais, two in Goiás, and three in the Northeast—for a total increased capacity of 1.82 million tons.

A major increase in construction projects, both public and private, nevertheless made imports necessary. During the year the tariff was decreased from 34 to 20 percent on an original quota of 450,000 tons, subsequently increased. Total 1968 imports came to 583,000 tons, and were received from Uruguay, Colombia, Rumania, Poland, and the U.S.S.R.

Fertilizer Materials.—In May of 1968 Fosforita Olinda, S.A., suspended its phosphorite operation in Pernambuco. Millions of tons of reserves remain, awaiting more favorable economic conditions. Apatite production gained 11 percent in 1968, but total natural phosphate production in Brazil supplied only 31 percent of requirements, the remainder being imported.

Serrana, S.A., began building a 200,000-ton-per-year apatite beneficiation plant at Jacupiranga, São Paulo, to produce a concentrate of 34 to 36 percent P_2O_5 content. Mitsui and Co. of Japan plan to produce 30,000 tons of soluble phosphate fertilizer in São Paulo.

The Departamento Nacional de Produção Mineral (DNPM) continued to drill and analyze the potassium salt beds discovered in Sergipe in 1965. Meanwhile, potassium chloride imports approached 300,000 tons in 1968, a 32-percent increase over 1967.

While the production of nitrogenuous chemicals increased in 1968, not all of this material necessarily was converted to fertilizer use. In addition, ammonium sulfate imports increased 38 percent over the 1967 level.

Salt.—Favorable weather conditions were largely responsible for Brazil's production of salt surpassing the 1966 level, and being 48 percent higher than that of the bad year of 1967. Imports declined from 49,000 tons in 1967 to 58 tons in 1968.

Sulfur.—Production increased 11.5 percent in 1968, but 235,000 tons, or 97 percent of demand, was imported. A facility for producing 900 tons of sulfuric acid daily from pyritic coal rejects at Imbituva, Santa Catarina, was to be constructed by the Japanese Mitsubishi organization; the official announcement forecast completion by 1971.

A prototype plant to recover sulfur from bituminous shales at the rate of 15 tons daily was approved for construction by Petróleo Brasileiro S.A. (PETROBRAS) in São Mateus do Sul, Paraná.

Chemoleum Corp. plans to build a plant near São Paulo to recover sulfur and by-product lime from gypsum. Cost is estimated at $26 million, and capacity at 300,000 tons of sulfuric acid annually. A similar plant is being discussed for Pernambuco.

MINERAL FUELS

Coal.—Run-of-mine coal output continued to increase; 1968 production exceeded that of 1967 by 11 percent. However, the ratio of washed coal to total output continued to decline, and usable production rose only 3 percent. Output of coal mined and washed, by States, during 1967 and 1968, follows, in thousand tons:

State	1967		1968	
	Run-of-mine	Washed	Run-of-mine	Washed
Paraná	316	226	343	217
Rio Grande do Sul	926	800	996	858
Santa Catarina	3,097	1,269	3,490	1,289
Total	4,339	2,295	[1]4,828	2,364

[1] Divergence due to rounding of data.

Source: Comissao do Plano do Carvao Nacional.

The Comissão do Plano do Carvão Nacional (CPCN) continued its exploration program for coal. Investigations were conducted in Paraná, Santa Catarina, Pará, and Piauí. No positive discovery of commercial coal has yet been reported.

At the beginning of 1968, Battelle Memorial Institute was engaged in a technical and economic study of the Brazilian coal industry.

Petroleum and Natural Gas.—Brazil's production of crude petroleum in 1968 rose to an average 164,000 barrels per day, a 12-percent increase over that of 1967; a level of 200,000 barrels daily was attained by the yearend. Natural gas withdrawals

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also increased 12 percent to 95.1 million daily cubic feet. The Miranga, Agua Grande, and Buracica fields in Bahia and the Carmópolis field in Sergipe were the principal producers.

Recoverable reserves of crude oil stood at 823 million barrels at the yearend, an increase of 23 million barrels during the year. Total natural gas reserves were estimated at 946 billion cubic feet, an increase of 9 percent over that of 1967.

Exploratory activity by PETROBRAS is summarized in the following tabulation:

	1967	1968
Geologic and geophysical exploration:		
Geologic surveying party months	132	115
Seismic surveying do	99	85
Gravimetric surveying do	56	22
Magnetic surveying do	-----	5
Electroresistivity sounding party months	34	20
Structural drilling do	12	12
Total do	333	259
Drilling:		
Exploratory wells drilled:		
Oil	25	24
Gas	4	NA
Dry	81	NA
Subtotal	110	115
Development wells drilled:		
Oil	91	99
Injection	13	1
Dry	6	16
Subtotal	110	116
Total	220	231
Footage drilled thousand feet	1,145	1,152

PETROBRAS I, Brazil's offshore drilling platform, is expected to work off the Sergipe-Alagoas coast in water depths up to 100 feet. The operating contract has been awarded to Société de Forages en Mer NEPTUNE. The Zapata Off-Shore Co., with a 1-year contract, began drilling operations early in May at a point 60 miles northeast of Vitória. The contract calls for a series of offshore holes over a 750-mile extent of coast between Vitória and Maceio. On September 22, Zapata's hole 1–SES–1–A found oil and gas at 3,250 feet, at a point 5 miles off Aracaju, Sergipe. Production will be deferred until completion of the drilling campaign. The oil has an API index of 39 to 40, and is of high quality.

Offshore drilling in 1968 amounted to 30,100 feet in 5 completed holes; drilling on two others was still in progress.

Two new PETROBRAS refineries went on stream during the year: Refinaria Gabriel Passos at Betim, Minas Gerais, and Refinaria Alberto Pasqualini at Canoas, Rio Grande do Sul. The new plants have daily capacities of 45,000 barrels each, bringing the totals to 400,000 barrels per day for PETROBRAS and 458,000 barrels per day for Brazil. Expansion of the Mataripe plant and construction of a large new refinery at Paulinia, São Paulo, are expected to be underway soon.

The lubricant unit at Mataripe, shut down in 1966 by explosion and fire, reopened on a small scale during 1968. PETROBRAS also operated asphalt plants at Mataripe, Cubatão, and Fortaleza, with a combined capacity of 8,430 barrels daily.

Imports of crude petroleum reached 95.8 million barrels in 1968, an increase of 22.5 percent. Of the total crude imports, 64 percent came from the Middle East and another 18 percent from Venezuela. The pipeline from Rio de Janeiro to Belo Horizonte operated successfully throughout 1968, carrying crude oil to the new Gabriel Passos refinery.

Technicians from the U.S.S.R. examined the site and circumstances of the proposed operation of Cia. Industrial de Rochas Betuminosas (CIRB) at Pindamonhangaba, São Paulo. The company intends to produce 35 million cubic feet of illuminating gas daily from the oil shale deposits of the Paraíba Valley; many byproducts are also mentioned. The shale, however, has a relatively high water content and contains less recoverable bituminous material than does shale elsewhere in Brazil. A pilot plant may be built.

PETROBRAS continued construction of its prototype shale oil plant at São Mateus do Sul.

Petrochemicals.—At the end of 1967, a decree authorized creation of a PETROBRAS subsidiary, PETROQUISA, to assure the petrochemical industry of adequate raw materials, particularly naphtha. Early in 1968, PETROQUISA and three private companies formed a new company, Petroquimica União. Petroquimica will establish a chemicals complex at Capuava, São Paulo, to convert an annual 930,000 tons of naphtha per year to ethylene, benzene, propylene, and other solvents and oils.

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The Mineral Industry of Bulgaria

By Roman V. Sondermayer [1]

Nonferrous metals, low-rank coals, and construction materials remained the principal mineral products of Bulgaria in 1968. In addition the country produced barite, clays, chromite, iron ore, manganese ores, pyrites, salt, sulfur, and iron and steel. The Bulgarian mineral industry was of minor worldwide significance, but it occupied an important place in the domestic economy, contributing to the social product [2] an amount estimated at slightly above 10 percent. The industry and its related facilities employed close to 190,000 persons, or about 9 percent of the total labor force of the country.

Bulgaria's trade in mineral commodities also made a significant contribution to the economy of the country. Mineral industry exports, predominantly raw materials and metal ingots, continued to be an important source of foreign exchange. Imports, mostly high-rank coals, crude oil, petroleum refinery products, iron ore, apatite, semimanufactured metal products, and mining industry equipment were essential to the domestic economy. Although the U.S.S.R. and other Communist countries were Bulgaria's principal trading partners, it also imported automated and sophisticated equipment from France, Belgium, United Kingdom, and Japan.

The most important developments in 1968 were made in the iron and steel and petroleum industries. At the Kremikovtsi Integrated Iron and Steel plant, a new blast furnace and a new shop for the manufacture of seamless pipes were under construction.

The offshore discovery of crude oil north of Varna and the construction of a new refinery near Pleven highlighted developments in the Bulgarian petroleum industry. The supply of some refinery products was inadequate.

The U.S.S.R. provided technical and economic assistance to advance the development of the Bulgarian mineral industry. Nevertheless, construction continued to move at a slow pace during 1968, mostly because of shortage of materials, lack of worker incentives, and political interference in management.

PRODUCTION

The output of most minerals and metals increased in 1968 but the increases were smaller than in the past. Lower grade ores accounted for a greater share of Bulgaria's output than they did in 1967. Mass production methods were becoming standard in many operations.

Data on oil production activities are limited, but as in the past, the turbo drill as well as conventional drilling methods was used in Bulgarian drilling operations. No reservoir pressure maintenance projects were reported in 1968. For the first time in the history of Bulgarian drilling, an oil well was drilled offshore from a trestle.

[1] Foreign mineral specialist, Division of International Activities.

[2] Bulgaria, like other Communist countries of East Europe, does not report its gross national product (value of all final goods and services produced), but rather publishes a figure for the social product, which generally excludes such items as banking fees, rent, education, defense, public administration, and health services.

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Table 1.—Bulgaria: Production of selected mineral commodities [1]

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967 •	1968 •
METALS					
Copper:					
Mine output, metal content	20	30	30	31	32
Blister, including secondary—tons	21,102	25,248	r 26,704	27,000	28,000
Refined electrolytic, including secondary—tons	20,605	23,885	25,662	26,000	27,000
Iron and steel:					
Iron ore and concentrate	722	r 1,804	r 2,613	2,700	2,700
Pig iron (including blast furnace ferroalloys)	457	695	r 903	950	950
Steel ingots and castings	475	588	r 699	700	750
Steel semimanufactures (total)	363	431	484	500	500
Lead, metal, including secondary—tons	87,499	93,421	92,847	96,600	97,000
Manganese ore, gross weight	52	42	30	29	30
Zinc, metal, including secondary—tons	58,573	65,764	76,815	73,900	73,000
NONMETALS					
Asbestos •—tons	1,200	1,300	1,300	1,800	1,800
Cement, hydraulic	2,586	2,681	2,856	3,358	3,400
Fertilizer materials, manufactured:					
Nitrogenous, gross weight	612	734	817	900	950
Phosphatic:					
Gross weight	491	498	495	496	496
Phosphorus pentoxide—content	90	94	96	96	96
Gypsum and anhydrite:					
Crude	129	174	163	170	170
Calcined	16	13	13	14	14
Kaolin	83	95	93	93	93
Lime (quicklime)	834	851	876	890	900
Pyrite:					
Gross weight	147	153	r 147	150	150
Sulfur content •—tons	61,740	64,260	61,740	63,000	63,000
Salt (all types)	182	125	113	125	115
Sulfur, elemental, recovered—tons	6,828	10,121	r 9,352	10,000	10,000
MINERAL FUELS					
Coal:					
Anthracite (marketable)	221	190	191	190	190
Bituminous (marketable)	r 388	362	300	300	300
Lignite and brown (marketable)	23,751	24,490	24,653	27,500	29,000
Coke, all types	r 471	r 733	r 800	800	800
Natural gas—million cubic feet	------	2,584	3,848	4,000	4,500
Petroleum:					
Crude oil	160	229	404	499	550
Refinery products:					
Gasoline, all types	307	371	418	595	600
Kerosine	42	73	85	92	92
Distillate fuel oils, diesel oil	494	625	826	r 926	930
Residual fuel oil	1,000	1,097	1,365	1,448	1,500
Lubricants	45	46	48	49	50
Asphalt, refinery and natural	50	57	57	58	58

• Estimate. r Revised.

[1] Bismuth, cadmium, gold, silver, barite, chromite, and tellurium are also produced but level of output is unknown.

Sources: Statisticheski Godishnik na Narodna Republika Bulgaria—1967 (Statistical Yearbook of the Peoples Republic of Bulgaria for 1967). Sofia, 1967, 559 pp. Rabotnichesko Delo (Sofia), Jan. 29, 1968.

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TRADE

Recent trade data were unavailable from Bulgarian sources. Partial information was compiled from the Soviet trade book, and these data are shown in tables 2 and 3.

Table 2.—Bulgaria: Exports of selected metals and minerals to the U.S.S.R.[1]

(Metric tons)

Commodity	1966	1967
METALS		
Iron and steel, semi-manufactures	5,100	58,400
Lead, metal including alloys	4,800	3,400
NONMETALS		
Barite	34,100	28,100
Talc	14,200	12,200

[1] Export statistics of Bulgaria for 1967 were not available in time for inclusion in this table. Exports to the U.S.S.R. have been compiled from the Soviet source Vneshnyaya Torogovlya S.S.S.R. za 1967. (Foreign Trade of the U.S.S.R. for 1967), Moscow, 312 pp.

Table 3.—Bulgaria: Imports of selected metals and minerals from the U.S.S.R.[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum metal, including alloys:		
Unwrought	10,100	14,900
Semimanufactures	3,416	2,097
Antimony metal, including alloys, all forms	506	326
Copper metal, including alloys, semimanufactures	992	930
Iron and steel:		
Ore and concentrate—thousand tons	908	954
Metal:		
Pig iron	137,300	157,200
Ferroalloys, all types	10,500	10,800
Semimanufactures:		
Tubes, pipes, fittings	40,600	48,600
Others	396,200	421,000
NONMETALS		
Asbestos	16,400	17,500
Cement	53,000	184,000
Clays and clay products: Products, refractory, including brick	32,500	31,400
Fertilizer materials: Crude, phosphatic (apatite concentrates)	288,000	274,500
FUELS AND RELATED MATERIALS		
Carbon black and gas black	1,641	5,040
Coal: Anthracite and bituminous—thousand tons	3,047	3,231
Coke and semicoke—do	158	195
Petroleum:		
Crude and partly refined—thousand tons	2,623	2,686
Refinery products:		
Gasoline, including natural	155,000	211,300
Kerosine, including jet fuels	9,800	8,700
Distillate fuel oils (diesel oil)	213,100	265,000
Residual fuel oil—thousand tons	933	1,185
Lubricants	51	57
Asphalt (including natural)	25,500	28,300

[1] Import statistics of Bulgaria for 1967 were not available in time for inclusion in this table. Imports from the U.S.S.R., the principal supplier of Bulgaria, have been compiled from Soviet source Vneshnyaya Torogovlya S.S.S.R. za 1967. (Foreign Trade of the U.S.S.R. for 1967), Moscow, 312 pp.

COMMODITY REVIEW

METALS

Copper.—With five mines and two smelters in operation, Bulgaria produced about 27,000 tons of electrolytic copper in 1968, an increase of approximately 9 percent over 1967 production. Bulgarian copper activities were centered around the Medet copper mine and the smelter at Pirodop. Most of the increase in copper

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production resulted from better utilization of existing facilities rather than from the commissioning of new mines and smelters.

Iron and Steel.—Kremikovtsi remained the focal point of the iron and steel industry of Bulgaria in 1968. A new blast furnace, the third one in the Integrated Iron and Steel Plant at Kremikovtsi, was under construction at yearend 1968. In addition, a specialist from U.S.S.R. helped in the construction of a plant for the manufacture of seamless pipe. Both projects at Kremikovtsi are scheduled for completion sometime in 1969.

Lead and Zinc.—Throughout 1968, about 100 lead-zinc mines, 13 beneficiation plants, and four smelters were operated by the Bulgarian Government. Production of lead and zinc was reported at approximately 97,000 tons and 73,000 tons, respectively, these figures showing a slight decline in production from that of 1967.

Tellurium.—Reports have indicated that tellurium was produced in Bulgaria for the first time during 1968. The lead and zinc plant at Kurdzali produced the first tellurium concentrates, which contained 60 to 80 percent metal. The concentrate is then processed in the Pirodop copper smelter. Neither annual production nor plant capacity was reported, however, it is believed that production is adequate to cover domestic demand and leave some tellurium for export.

NONMETALS

Cement.—Bulgaria's plans for expansion of the cement industry were carried out during 1968. The country is endowed with large quantities of raw materials for cement production, and most of the new facilities will produce cement for export. The "General Vladimir Zaimov" plant near Plovdiv, commissioned in mid-1967, came into full production at the end of 1968; the plant has reportedly reached its planned capacity of 500,000 tons of cement per year.

Fertilizers.—Preparations continued for the construction near Varna of the first combine for the production of complex nitrogen-phosphoric fertilizers in Bulgaria. The plant will be constructed by the French firm GEXA (the export branch of Alsthom, Fives-Lile-Cail, and Chantier de l'Atlantique), in association with the British company, Humphreys and Glasgow, and the Belgian group Evance Copee Rust. The overall cost is estimated at $40 million, of which $23 million will go to the French firm.

A large chemical combine, with a reported annual capacity of 200,000 tons of liquid ammonia, 400,000 tons of ammonium hydrate, and 600,000 tons of carbide, came on stream in Vratsa. Technical expertise during construction was provided by contracting firms from Belgium, France, and the United Kingdom. The plant will employ approximately 85 engineers and 250 technicans.

MINERAL FUELS

Because of the insignificant production of crude oil, natural gas, and bituminous coal, Bulgaria's principal sources of energy during 1968 continued to come from low-rank coals lignite and brown coal. As in the past imports were necessary in order to provide energy supplies for the country.

Coal.—In 1968, the total production of coal rose sharply from that of the previous year, reaching a total of 29.5 million metric tons. The breakdown by quality was not reported. However, more than 90 percent was believed to be lignite, as in past years.

The Maritza Istok Basin was the focal point of the Bulgarian Coal industry in 1968. Opencast mining methods were used on all workings in the basin. Equipment from East Germany, Czechoslovakia, and the U.S.S.R. helped to increase production. Because the coal in Maritza Basin is low-grade lignite of low calorific value, the largest part of the output was in a power-plant near the mine. The U.S.S.R. provided most of the imported high-rank coal.

Petroleum and Natural Gas.—The Bulgarian petroleum and gas industry remained small. Crude oil was produced in token amounts, and refinery production covered only about 70 percent of domestic demand in 1968.

Oil was discovered 400 meters offshore in the Black Sea near the village of Shabla. The discovery came after 3 years of exploration. The rig and the platform were built under the supervision of personnel from the U.S.S.R. The reported depth of the producing formation is about 350 meters. The oil horizon is an undersea extension of the oldest oilfield in Bulgaria, located in the Tolbuhin Okrug north of Varna.

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The construction of the Pleven refining and chemical complex continued during 1968. The plant is located near the Dolni Dubnik oilfield. The Pleven refinery will have an annual capacity of 1 million tons when it is completed in 1970, 1 year behind the previously announced date. The complex was designed by specialists from the U.S.S.R. and is to be equipped by the Soviet as well.

The U.S.S.R. and Bulgaria have concluded a contract for deliveries of natural gas from the U.S.S.R. The U.S.S.R. will construct a 700-kilometer pipeline from Izmailia to Varna, Plovdiv, Burgas, and Sofia. The line is expected to carry approximately 3 billion cubic meters of natural gas per year when it is completed in 1975.

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The Mineral Industry of Burma

By Arnold M. Lansche [1] and K. P. Wang [2]

From the viewpoint of economics and industry, 1968 was another disappointing year for Burma. Production was low, prices soared, and exports continued their downward trend causing a worsening of the balance of payments position. The Government assumed control of more of the nation's industry, the level of insurgency remained high, and managerial and technical talent continued to emigrate. During the year, the Government took over 169 additional industrial concerns, including 16 in "metals" and nine in "engineering."

Burma no longer produces quantitiwise any mineral of world consequence. Production from the historically famous Bawdwin mine near Lashio and the Chinese border dropped to the lowest level in a decade, partly because of conversion of operations to extract more low-grade ores. Tin and tungsten production was down slightly; some of these mines in Tavoy and Mergui may be closed. However, oil production increased, with discovery of new fields and completion of additional wells. In fact, the country claimed self-sufficiency for petroleum at yearend 1968. Cement output also increased.

According to official Burma national budget estimates, total "mining" output in fiscal 1967–68 was $28.9 million [3] This figure includes crude oil and limestone, but not salt and value added from mineral and metal processing. Burma's gross national product (GNP) for 1967–68 was reported at $2.06 billion at current prices. Targets for mineral output and GNP covering fiscal 1968–69 were $37.7 million and $2.24 billion, respectively. In recent years, targets have seldom been fulfilled, and value figures have been exaggerated because of inflation and free market rates.

Only about 54,000 workers out of a labor force of 10 million and a population of some 26.4 million were said to be engaged in mining during 1968. Installed electric power capacity was only 196,300 kilowatts at yearend 1968; far from sufficient to supporting extensive mineral, and industrial development.

Under the 4-year national economic plan ending 1969–70, special attention was to be given to mineral development. Financing was to come predominantly from domestic sources, since foreign aid is limited and foreign investment almost nonexistent. Outlays for mineral development by the Government of Burma have been modest, with expenditures approximating receipts. The national budget showed the following anticipated expenditures for fiscal 1967–68: People's Oil Industry, $71.4 million; People's Bawdwin Industry (PBI), $7.8 million; Mineral Development Corporation (MDC), $3.7 million; Ywama Steel Mill, $5.9 million; and Thayet Cement Factory, $3.3 million.

The Ministry of Mines formed a Geology, Petroleum, and Mining Advisory Council in 1967, to function initially for 2 years. Headed by the Secretary of the Ministry of Mines, its primary objectives are to advise the Minister of Mines on technical matters, submit long- and short-term plans for prospecting and extraction of oil, minerals, and other resources, in accordance with available manpower, capital, and equipment.

The MDC reported about $200 million worth of ore deposits in 1966–67, including 14 million tons of copper ore (0.5–1.0 percent Cu) in the Monywa district and unspecified tonnages of copper ore in Bhama and Mandalay and in Heho, South-

[1] Physical scientist, Division of International Activities.

[2] Supervisory physical scientist, Division of International Activities.

[3] Burma's fiscal year is October to following September. Burma's currency is the Kyat. The official exchange rate has been 4.76 Kyats to US$1 (all figures in this chapter have been converted on this basis), whereas the free market rate during 1968 was 15 to 20 Kyats to US$1.

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ern Shan States. Lead was reportedly found in Mamyo, Kyaukse, and Wa State, and zinc in Southern Shan States. In 1968, a nonferrous deposit deemed as significant was discovered in the Northern Shan States.

PRODUCTION

The bulk of Burma's mineral output comes from state enterprises, with the Government outproducing private industry by about 5 to 1. In 1968, the Government took an even firmer grip on mineral production. Only some small tin-tungsten and nonmetal mines were in private hands. A significant quantity of production was believed smuggled out of the country, and hence was not recorded.

Mineral output value reported by the Burmese as $28.9 million in fiscal 1967–68 probably does not include some private and unrecorded output. The following breakdown was given, in percentages: crude oil, 39.7; nonferrous output of the Bawdwin enterprise, 23.5; stone, 18.4; limestone, 7.3; and tin-tungsten, 6.3. Also for fiscal 1967–68, salt output was reported at $2.43 million and cement output at $4.22 million (as compared with output of limestone, the main raw material to make cement, at $2.14 million).

Table 1.—Burma: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p [1]
METALS					
Antimonial lead (18 to 20 percent Sb)	530	560	e 500	e 400	300
Copper matte (40 percent Cu)	348	320	236	[1] 180	100
Gold, refined e troy ounces	200	200	200	200	200
Iron and steel:					
Iron ore	5,000	5,000	10,000	10,000	NA
Steel ingot e	15,000	18,000	21,000	21,000	NA
Rolled steel e	12,000	15,000	20,000	20,000	NA
Lead:					
Concentrate (50 to 60 percent Pb)	31,002	32,253	18,476	13,332	NA
Refined metal (99.99 percent Pb)	18,053	e 16,000	e 14,000	e 13,000	8,500
Nickel speiss (20 to 30 percent Ni)	378	245	354	[1] 130	100
Silver, refined thousand troy ounces	1,867	1,638	r 1,063	917	780
Tin concentrate (68 to 72 percent Sn) long tons	830	664	355	442	500
Tin-tungsten concentrate (35 percent Sn and 30 percent WO_3) long tons	957	606	367	448	NA
Tungsten concentrate (55 to 65 percent WO_3)	86	27	45	95	100
Zinc concentrate (54 to 56 percent Zn)	14,666	14,255	r 11,635	8,466	7,500
NONMETALS					
Barite	NA	1,760	e 8,000	[1] 9,400	10,080
Cement thousand tons	131	135	141	132	170
Gypsum	9,150	450	e 2,000	e 2,000	3,600
Limestone	107,000	116,500	e 400,000	e 400,000	516,000
Marl	62,100	99,800	100,000	100,000	NA
Salt thousand tons	127	132	118	134	137
MINERAL FUELS					
Coal, bituminous thousand tons	10	15	[1] 15	[1] 17	9
Petroleum:					
Crude thousand 42-gallon barrels	4,164	4,065	4,255	4,392	5,630
Refinery products:					
Gasoline do	1,216	1,300	1,467	1,453	NA
Kerosine do	923	1,050	1,478	1,472	NA
Other do	1,356	1,450	3,021	3,402	NA
Total do	3,495	3,800	5,966	6,327	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Fiscal year October through September. Figures are for first 9 months of year noted and 3 months of previous year.

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TRADE

Overall exports have declined every year since fiscal 1963–64. Exports in 1967–68 were only about $110 million, nearly a fifth lower than the previous year. Meanwhile, imports soared to about $220 million, a 57-percent increase over those of the previous year. Minerals and metals contributed in recent years approximately 3 to 5 percent of all exports and 5 to 10 percent of all imports.

During calendar 1967, Burma's exports of metals and ores were reported at $4.8 million and 19,600 tons, roughly a 50-percent decline from calendar 1966 value. Most exports represent the output of the Bawdwin enterprise. Burma has not been a net exporter of oil since the end of World War II. Values of selected imports of mineral and metal products are shown in the following tabulation.

	Value (million dollars)	
	1966	1967
Base metalsand manufactures of base metals	13.1	10.3
Cement	0.14	0.68
Chemical elements and compounds	3.0	2.1
Coal and coke	1.2	2.2
Fertilizers, manufactured	1.2	3.1
Refined mineral oils	4.5	1.9

COMMODITY REVIEW

METALS

Iron and Steel.—The nine-man Iron and Steel Board set up in 1966 considered an integrated steelworks as feasible for Burma. The existing rolling mill at Ywama was said to be producing annually only about 1,000 tons each of iron chain, square rails, and galvanized iron sheets; 8,000 tons of various types of bars; 1,300 tons of barrel sheets; and 2,400 tons of corrugated galvanized iron sheets. Total value of this annual output is approximately $5 million, compared with $10 to $20 million worth of iron and steel products imported annually in recent years. Japan alone supplied over 10,000 tons of steel products to Burma in 1967.

Another iron ore survey lasting 6 months was made in 1968, in the districts of Taunggyi, Loikaw, and Mamyo, and the islands of Ko Khyun and Ma Puteh. Taunggyi's reserves were ascertained at 63 million tons, a little more than previous evaluations. The country still did not produce iron ore, except small amounts of ochre for paints.

Lead, Zinc, Copper, Silver, and Nickel.—The PBI, with a mine at Bawdwin and a smelter at nearby Namtu, was again virtually the sole producer of these metals. For the year ending September 1967, this company extracted about 13,400 metric tons of refined lead, 9,980 tons of zinc concentrate, 1.02 million ounces of silver, 407 tons of antimonial lead, 184 tons of copper matte, and 128 tons of nickel speiss, from about 155,000 tons of ore. Ore reserves at the beginning of 1968 totaled about 6 million tons analyzing 11.2 percent lead, 5.6 percent zinc, 0.3 percent copper, and 7.8 ounces of silver. Modernization of mines was aimed at a yearly output of 350,000 tons of low-grade ore by fiscal 1969–70.

Capacity of the lead refinery was raised one-fourth in 1968, and a new concentrator and two zinc refineries were planned. Construction of these facilities and conversion of the mine to work low-grade ores have disrupted production. Unconfirmed reports show the following outputs for PBI during fiscal 1967–68: Refined lead, 8,500 tons; zinc concentrate, 7,500 tons; silver 780,000 ounces; antimonial lead, about 300 tons; and copper matte and nickel speiss, each about 100 tons. After making these changes, PBI aims to produce annually 12,000 tons of refined lead, 11,000 tons of zinc concentrate (and eventually a corresponding amount of zinc metal), and 1 million ounces of silver.

Reportedly, PBI and MDC jointly discovered a significant nonferrous deposit in a 5-square-mile area at Nawnghkio in Northern Shan States, which may yield 840,000 tons of lead, 260,000 tons of zinc, 20,000 tons of copper, and 34 million ounces of silver. MDC was trying to interest the Japanese Overseas Mineral Resources Development Co. Ltd. to help develop the Monywa copper deposits, with no tangible results as yet.

Tin and Tungsten.—Tin and tungsten are produced both separately and mixed,

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their genetic origin being related. Combined output of the two minerals in fiscal 1967–68—800 to 900 tons worth about $1.8 million—was not much different from that in 1966–67. However, the value of tin declined slightly whereas that of tungsten went up, possibly on account of high tungsten prices.

The once-famous Mawchi tin–tungsten mine was operating at a fraction of historic peak output, and most other mines found it difficult to make ends meet.

NONMETALS

Cement.—Burma's only cement plant, located at Thayetmyo, is also a Government enterprise. With two wet process rotary kilns, it had been producing 130,000 to 142,000 tons annually valued at $3 to $3.5 million. As a result of an expansion program to meet growing demand, Burma's cement output in fiscal 1967–68 increased to 170,000 tons and the target for 1968–69 was set at 240,000 tons.

Fertilizer Materials.—Consumption of fertilizers in fiscal 1967–68 was said to be about 160,000 tons, a very large increase over that of the previous year. Most of this had to be imported, and many million dollars worth of foreign exchange were expended. Supply of farmyard manures became so inadequate that inorganic fertilizers had to be used to prevent depletion of soil fertility. It has been said that Burma could consume 1.2 million tons of ammonium sulfate equivalent annually, including 550,000 tons of urea, 450,000 tons of superphosphate, and 160,000 tons of nitrate of potash. So far, only small fractions of available agricultural land use chemical fertilizers.

Salt.—Demand for salt has been increasing. Hitherto, salt has been produced only from brines, with output usually fluctuating between 100,000 and 150,000 tons annually. During 1968, the State Pilot Factory in Moulmein successfully tested the production of high-grade sea water salt by solar evaporation. This may have some bearing on Burma's target for producing 166,000 tons of salt during fiscal 1968–69.

Other.—Burma may have several million tons of barite reserves. One of the better known deposits is Pyittawye in Kyaukse district. The country has been producing barite at an annual rate of some 10,000 tons.

Beryl has been found in Southern Shan States, bentonite in Shweb District, gypsum in Myingyan district, graphite near Mogot, and fluorspar near Bawhnington in Southern Shan States. Several hundred tons each of clays, talc, soapstone, manganese ore, and fluorspar are said to be produced annually.

MINERAL FUELS

Coal.—The Kalewa coalfield in northwestern Burma has been producing nominal quantities of low-rank coal, ranging from perhaps 8,000 to 17,000 tons annually in recent years. An expansion program appeared to be underway, with the target for fiscal 1968–69 set at 48,000 tons and an eventual goal of 400,000 tons yearly in the early 1970's. Hitherto, the Burmese have not been successful in developing this field because of the type of coal and transportation difficulties.

Petroleum.—Burma's oil output, although vital domestically, is small by world standards. Production of crude oil in fiscal 1967–68 was 28 percent more than in fiscal 1966–67. The target of 7,170,000 barrels in fiscal 1968–69, if achieved, would be another increase of 27 percent over that of fiscal 1967–68. Burma had imported 19.9 percent of its crude requirements in 1967, and 9.2 percent in 1968. The hope was to cease importation of crude oil by 1969. All crude was refined at two domestic refineries with a combined daily capacity of 26,300 barrels. Another refinery is planned.

The People's Oil Industry (POI) has contracted with the Japan Petroleum Development Corp. to conduct seismic survey along 2,000 miles of the Arakan Coast beginning in February 1969. The Government-owned POI program for fiscal 1967–68 envisages 300,000 feet of exploratory drilling in the delta region—Prome, Thayetmyo, Myanaung, and Henzada—and 100,000 feet of production drilling in Chauk and Yenangyaung. In mid-1967 there were 238 oil wells at the Chauk field, 439 at Yenangyaung, 23 at Myanaung, and eight at Prome. The new Shwepyitha oilfield came on stream, with eight wells operating at yearend 1968.

According to the Government of Burma, expectations for POI were not realized in fiscal 1966–67, and the industry operated at a net deficit of about $5.9 million. A surplus of approximately $6.8 million was anticipated for fiscal 1967–68.

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The Mineral Industry of Canada

By Lester G. Morrell [1]

For the 10th successive year, Canada's mineral industry set new production records. Gross value of output at $4.38 billion,[2] in 1968 represented an increase of 7.5 percent above that of 1967, but fell below the 8.5-percent average annual growth rate of the 1958–68 period. The role of minerals in the national economy as recorded by the Dominion Bureau of Statistics and the Department of Energy, Mines and Resources is summarized in the following tabulation:

		1965	1966	1967	1968
Gross national product (GNP)	value, millions	48,191	53,746	57,451	62,315
Mineral production [1]	do	3,465	3,675	4,069	4,380
Index of industrial production (1961=100)		139.1	148.9	151.7	159.2
Index of mineral industry production (1961=100)		131.6	136.5	145.2	152.0
Total labor force	thousands persons	7,141	7,420	7,694	7,919
Mineral industry labor force [2]	do	114.3	116.8	118.5	120.4
Total domestic exports	value, millions	7,886	9,315	10,278	12,229
Mineral commodity exports [3]	do	2,574	2,889	3,209	NA
Total imports	do	7,986	9,126	10,250	11,439
Mineral commodity imports [3]	do	1,656	1,687	1,790	NA

[1] Gross value of products as reported by Dominion Bureau of Statistics.
[2] Mining (including milling) metal, coal and nonmetals and employees on petroleum and gasfield works.
[3] Crude ores, concentrates, scrap and semifabricated materials of mineral origin.

Although each of the commodity sectors showed substantial increases in 1968, metallic minerals valued at over $2,303 million in 1968 recorded the greatest annual gain —9.0 percent—and accounted for nearly 53 percent of the total value of Canada's mineral production. Nonmetallic minerals, including structural materials, were up 5.7 percent, and mineral fuels were 6.6 percent higher than in 1967.

Of the more than 60 mineral products regularly produced in Canada, the 10 leaders, which accounted for about 83 percent of the total, were crude petroleum, $863.4 million; copper, $548.6 million; iron ore, $514.2 million; nickel, $487.5 million; natural gas (including sulfur and liquid byproducts), $396.5 million; zinc, $304.9 million; asbestos, $175.8 million; cement, $144.8 million; sand and gravel, $118.5 million; and silver, $97.9 million.

The metal mines of Ontario produced over $1 billion and were the principal contributors to that Province's 28.3 percent share of the national total in 1968. Alberta, predominantly from petroleum and natural gas, accounted for 22.8 percent. Quebec, British Columbia, and Saskatchewan supplied respectively 15.5 percent, 8.3 percent, and 7.8 percent. Newfoundland, Manitoba, and the Northwest Territories contributed 6.8 percent, 4.3 percent, and 2.6 percent, respectively, and New Brunswick, Nova Scotia, and Yukon Territory a total of 3.6 percent. In international perspective, Canada is the world's leading producer of nickel, silver, zinc, and asbestos; second (to the United States) in uranium, gypsum, and molybdenum and (to the U.S.S.R.) in potash. In 15 other metals and minerals, Canada ranks among the top four world producers.

General wholesale price indexes for minerals and metals categories in 1968 and

[1] Mining engineer, Division of International Activities.
[2] Values have been converted from Canadian dollars (Can$) to U.S. dollars at the rate of Can$1 equals US$0.925.

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1967 (the latter in parentheses) related to the 1935–39 base period were as follows: Nonferrous metals, 250.8 (240.2); iron products 276.8 (274.4); nonmetallic minerals 206.0 (199.2); and chemical products 213.7 (212.6). The average hourly earnings of a mine employee was $2.98 in December 1968, compared with $2.75 the same month in 1967. Profits, before taxes, reported by mining, quarrying, and petroleum companies totaled $572 million in 1968 ($524 million in 1967). According to Department of Energy, Mines and Resources estimates, capital and repair expenditures by the mining industry totaled $1,089 million in 1968, compared with $1,174 million in 1967 and $1,178 million in 1966. Following the pattern of recent years, about half of this total went to petroleum and natural gas projects.

Despite threats of legislative restrictions, exploration activities continued at a high level through 1968. Spurred by the discovery of oil at Prudhoe Bay on Alaska's Arctic coast, oil companies have rushed to investigate the oil and gas potential, and acquire exploration rights in the coastal and offshore regions of Canada's Arctic islands. Search for metallic minerals has extended across the length and breadth of the Dominion. Active exploration continued through 1968 in the Bathurst area of New Brunswick and the Gaspé Peninsula, Quebec, for lead, zinc, and copper; and in the Noranda-Val d'Or-Timmins region for base metals and gold. Uranium has been the object of search at Mont Laurier and Mistassini, Quebec, in the Bancroft and Elliot Lake areas of Ontario, and in the Beaverlodge and Wollaston Lake areas of Saskatchewan. Exploration activities on copper prospects have been particularly intense in British Columbia, at Stikine, Highland Valley, Babine Lake, and Princeton, and at Port Hardy on Vancouver Island. Copper has also been investigated in the Whitehorse area, Yukon Territory, and at Coppermine on Coronation Gulf in northern Northwest Territories.

Expansion of production facilities and development of new mines continued at a dynamic rate during 1968. According to a recent survey [3] 12 new mines started production in 1968, 20 more are scheduled to commence in 1969, and 12 in 1970. The emphasis has been on new sources of nickel, copper, and lead-zinc in Ontario, Manitoba, British Columbia, and Yukon Territory. Byproduct molybdenum is destined to increase with the opening of several new copper-molybdenum mines in British Columbia. Three new potash producers came on stream in Saskatchewan during 1968 and two more will start in 1969. Development plans and contracts for greatly increased exports to Japan from new large-scale operations in the southern British Columbia-Alberta border region are well along. The year 1968 was the first full year of operation at the reactivated Pinchi Lake, British Columbia, mercury mine, and at yearend Tantalum Mining Corp. of Canada was about ready to start production of tantalum concentrates at Lac du Bonnet, Manitoba. This will be the first major tantalum operation in North America, and one of the world's largest.

Although concern has continued regarding the impact of tax revisions as proposed by the Carter Commission, and foreign investment policies of the new U.S. administration, these factors have had little visible effect on Canada's mineral industry. Investment in mines, quarries, and oil wells was estimated at $930 million in 1968, slightly higher than that of 1967.

Recent Dominion legislation has simplified requirements and provided for cost assistance, up to 40 percent, on Government approved mineral search projects under the Northern Mineral Exploration Program. Following announcement of Nova Scotia and Dominion Government cooperation regarding assistance to the Cape Breton coal industry in 1967, the Federal and New Brunswick Governments combined during 1968 in providing assistance to the coal mines at Minto. Panarctic Oils Ltd., the consortium of 20 companies and the Federal Government (45 percent) has completed preliminary surveys of Arctic island areas and will commence test drilling on Melville Island in 1969.

The Province of Alberta, early in 1968, announced an increase in the oil production limit applicable to Athabasca bituminous sands from 45,000 to 150,000 barrels per day.

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[3] The Northern Miner. Toronto, Ontario, Apr. 24, 1969, pp. 1, 5, 11.

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PRODUCTION

Canada's mineral production in 1968 as recorded by the Dominion Bureau of Statistics included 62 basic commodities, consisting of 27 metallics, 26 nonmetallics, five structural materials, and four fuel minerals. With the exception of a slight drop in the total value of certain construction materials (stone, sand, and gravel) each of the major categories recorded increases over those of the previous year. Substantial quantity increases were in copper, iron ore, lead, nickel, platinum-group metals, silver, zinc, fluorspar, gypsum, potash, sulfur, natural gas, petroleum, and cement. Higher unit prices were in part responsible for the 8-percent increase in annual value of all products. Although metallic minerals again contributed over half of this total, products of oil and gas wells comprised 27 percent, and 20 of the mineral items made up 95 percent of Canada's 1968 mineral production.

Table 1.—Canada: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum	764,426	753,422	807,318	884,904	893,577
Antimony [1]	722	591	638	575	510
Arsenic, white	147	183	318	343	314
Bismuth [2]	181	194	238	308	290
Cadmium [3]	1,258	796	1,468	2,194	2,467
Calcium—kilograms	62,758	72,318	113,026	246,614	202,126
Cobalt [4]	1,444	1,655	1,593	1,635	1,582
Columbium concentrate (shipments)	1,883	2,060	r 2,335	2,000	1,921
Copper:					
Mine, recoverable	441,706	r 460,736	461,109	546,711	551,851
Smelter, refined	370,077	393,837	393,647	453,611	476,232
Gold—thousand troy ounces	3,835	3,606	3,319	2,962	2,688
Iron and steel:					
Iron ore—thousand tons	34,768	36,250	r 36,914	38,390	44,791
Pig iron and ferroalloys—do	6,093	6,587	6,714	6,449	7,756
Steel ingots and castings—do	8,283	9,134	9,074	8,795	10,207
Rolled steel—do	9,123	10,005	9,900	8,408	8,559
Lead:					
Mine, ore and concentrate, content	187,205	274,832	293,180	308,172	327,610
Refined, primary	137,322	169,175	167,711	176,732	183,342
Magnesium	8,485	9,170	6,099	8,062	8,961
Mercury—76-pound flasks	73	20	---	---	e 5,000
Molybdenum	556	4,335	r 9,342	9,696	9,075
Nickel [5]	207,287	242,496	r 216,453	224,033	239,082
Platinum-group metals—troy ounces	376,238	463,127	396,059	401,263	464,400
Selenium—kilograms	211,258	232,273	r 261,034	328,661	321,687
Silver—thousand troy ounces	29,903	r 32,272	r 32,825	37,206	45,389
Tellurium—kilograms	35,281	31,658	32,767	33,212	29,571
Thorium (ThO_2)—do	44,403	21,019	39,641	53,244	63,136
Tin, mine—long tons	157	168	r 312	195	150
Titanium slag (70–72 percent TiO_2)	494,164	495,248	476,067	546,539	610,415
Tungsten, concentrate (W content)	381	r 1,344	r 1,495	e 100	1,295
Uranium (U_3O_8)	6,609	4,031	r 3,567	3,391	3,360
Yttrium (Y_2O_3)—kilograms	---	---	9,400	78,268	50,497
Zinc:					
Mine, ore and concentrate, content	662,186	r 826,381	949,790	1,133,054	1,155,084
Refined, primary	306,380	r 325,224	347,100	367,499	387,307
NONMETALS					
Asbestos—thousand tons	1,289	1,259	r 1,351	1,317	1,448
Barite	153,449	184,180	200,829	156,281	124,918
Cement [6]—thousand tons	7,119	7,645	r 8,102	7,253	7,511
Clays and products [7]—value, thousands	$37,768	$39,625	$39,734	$41,030	$42,795
Diatomite	1,037	74	64	NA	NA
Feldspar (shipments)	8,300	9,892	9,910	9,429	9,714
Fluorspar [8]	87,000	102,000	72,000	85,000	89,000
Gypsum and anhydrite—thousand tons	5,770	5,720	5,421	4,695	5,575
Lime—do	1,398	1,470	r 1,411	1,291	1,239
Lithium concentrate (Li_2O) [9]	479	460	115	244	---
Magnesite and brucite—value, thousands	$3,302	$3,710	$3,652	$3,252	$2,515
Mica (shipments)	544	248	247	---	---
Nepheline syenite	263,356	308,425	r 332,661	364,326	295,255
Potash (K_2O equivalent)	778,679	1,352,878	1,805,336	2,162,051	2,622,430
Pyrite and pyrrhotite	319,191	r 346,705	296,606	342,862	290,381
Salt—thousand tons	r 3,618	4,159	4,075	4,864	4,434
Sand and gravel—do	161,900	186,208	197,075	190,205	180,102
Sodium sulfate	302,331	313,403	367,693	388,562	425,539

See footnotes at end of table.

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Table 1.—Canada: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS—Continued					
Stone:					
Crushed—thousand tons	57,082	r 59,965	e 69,000	73,152	67,752
Building and ornamental [9]—do	245	186	e 193		
Sulfur [10]—do	2,182	2,450	r 2,453	2,804	2,859
Talc, soapstone and pyrophyllite (shipments)	52,736	47,933	63,634	55,034	70,125
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Bituminous—thousand tons	8,460	8,641	8,449	8,516	7,945
Lignite—do	1,809	1,872	1,885	1,822	2,041
Coke, high-temperature—do	3,940	3,963	4,015	4,019	4,818
Fuel briquets—do	54	63	52	e 38	NA
Natural gas—million cubic feet	1,327,664	1,442,448	1,841,833	1,471,725	1,642,636
Peat moss—thousand tons	232	261	258	255	261
Petroleum:					
Crude—thousand 42-gallon barrels	274,626	296,419	320,467	351,287	435,906
Refinery products:					
Gasoline, total—do	124,988	128,652	136,369	141,967	149,736
Kerosine and jet fuels—do	25,414	25,379	26,198	27,562	28,174
Distillate fuel oil—do	94,139	99,653	107,770	106,230	114,412
Residual fuel oil—do	47,635	47,730	51,821	54,598	61,685
Lubricants—do	1,816	1,832	1,735	2,028	1,892
Other products—do	27,123	28,342	31,820	32,600	32,724
Refinery fuel and loss—do	21,266	23,468	25,626	25,390	27,328
Total—do	342,381	355,056	381,339	390,375	415,951

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Antimony content of antimonial lead alloys, flue dust, and dore slag.
[2] Refined metal and bullion plus recoverable bismuth content of concentrates exported.
[3] Refined metal from domestic ores plus cadmium content of some exported ores and concentrates.
[4] All forms; excludes the cobalt in nickel sinter shipped to United Kingdom by International Nickel Co., but includes cobalt in Falconbridge nickel-copper matte to Norway.
[5] Refined nickel and nickel in produced oxide and recoverable nickel in matte exported.
[6] Cement shipped or used by producers.
[7] Value including bentonite and products from common, stoneware, fire clay and other types of clay.
[8] Spodumene concentrates.
[9] Building, ornamental, paving and similar uses of granite, limestone, marble, slate, and sandstone.
[10] Includes sulfur from natural gas and from pyrite, pyrrhotite, and smelting of sulfide ores.

TRADE

In 1968 the value of exported crude and semimanufactured mineral products was estimated at $3.3 billion or about 75 percent of the value of the mineral industry output and 28 percent of Canada's total exports. The metals sector, dominated by copper, nickel, and iron ore, accounted for $2.4 billion. Nonmetallic minerals, topped by $179 million worth of asbestos, were valued at $320 million; and fuels, of which $560 represented the value of natural gas and crude petroleum, totaled $620 million. As in previous years the great bulk of mineral exports were to the United States. Summaries for 1967 show United States as the destination of about 60 percent of mineral and metal exports; United Kingdom 15 percent, Japan about 8 percent, and the remainder to many other countries.

Canadian 1968 imports of minerals and primary metal products were valued at $1.5 billion, or about 13 percent of total merchandise imports. Fuels, largely crude petroleum pipeline-transported and coal, from the United States to the industrial areas of eastern Canada, totaled $726 million. Metallic imports totaling $690 million included $280 million of steel semimanufactured products, a large proportion of which was supplied by U.S. mills. Nonmetallic mineral imports were valued at $78 million. Among these, phosphate rock from United States and unset and industrial diamond constituted major items.

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Table 2.—Canada: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Alumina, Al content	11,843	11,458	United States 10,301.
Scrap	41,522	48,343	United States 32,923; Italy 10,014.
Pigs, ingots, wire bars, etc	649,890	690,049	United States 329,047; United Kingdom 127,876; Japan 92,770.
Bars, rods, sheets, castings	30,959	27,824	United States 8,715; Republic of South Africa 4,036; New Zealand 3,853.
Foil	266	210	New Zealand 71; United States 43; United Kingdom 37.
Fabricated materials, n.e.s	11,193	9,176	Mexico 2,903; United States 1,759.
Cadmium	913	761	United Kingdom 362; United States 354.
Calcium metal kilograms	110,132	232,693	United States 187,832.
Cobalt:			
Metal	285	680	Belgium-Luxembourg 315; United States 306.
Oxides and salts, gross weight	593	877	United Kingdom 870.
Columbium concentrate [1] kilograms	691,400	404,098	All to United States.
Copper:			
Ore and matte, metal content	86,081	117,005	Japan 84,941; Norway 13,804.
Scrap, slag, sludge	27,023	28,215	United States 8,902; Japan 8,866; West Germany 3,934; Spain 3,457.
Refinery shapes	172,992	250,309	United States 133,447; United Kingdom 85,281.
Semimanufactures:			
Bars, rods, shapes, etc	26,924	22,391	United States 8,024; Switzerland 2,568; Pakistan 2,286.
Pipe and tubing	15,126	9,434	United States 5,550; New Zealand 1,220.
Wire and cable	2,791	2,053	United States 1,376.
Iron and steel:			
Iron ore thousand tons	31,186	31,911	United States 23,880.
Pig iron do	460	441	United States 347; Japan 44.
Ferroalloys:			
Ferrochrome	32	---	
Ferromanganese	5,191	3,936	United States 3,932.
Ferrosilicon	34,494	38,037	United Kingdom 22,741; United States 10,565; Japan 3,979.
Other, n.e.s	5,400	1,073	United States 780; Australia 219.
Steel:			
Ingots and other primary forms. thousand tons	200	160	United States 153.
Hot and cold rolled products. do	602	696	United States 345; United Kingdom 104.
Pipes and tubes, iron and steel. do	88	69	United States 59.
Lead:			
Ore and concentrate, metal content	102,452	114,481	Japan 38,677; Belgium-Luxembourg 28,587; United States 27,487.
Pigs, blocks, and shot	96,586	120,038	United Kingdom 46,429; United States 41,371.
Alloys, scrap, and metal, n.e.s	5,990	8,065	United States 7,152.
Magnesium [e]	5,494	5,883	United States 2,429; United Kingdom 2,182.
Molybdenum, ore and concentrate content.	NA	10,792	United Kingdom 2,970; Japan 2,639; Netherlands 1,584.
Nickel:			
Ore, matte, and speiss, metal content.	75,828	75,897	United Kingdom 41,675; Norway 27,513.
Scrap	1,073	1,826	United States 1,037; Japan 276; Netherlands 203.
Oxide, metal content	30,509	31,030	United States 20,054; United Kingdom 4,388.
Ingots and other refined forms	120,395	116,718	United States 94,388; United Kingdom 15,864.
Fabricated products, n.e.s	3,517	4,028	United States 2,956; France 468.
Platinum-group metals:			
Concentrate, residues and matte, content troy ounces	431,723	457,098	United Kingdom 447,130.
Scrap do	32,406	26,397	United States 15,355; United Kingdom 6,982.
Metals do	7,604	18,757	United Kingdom 17,497.
Selenium metals and salts, selenium content. kilograms	266,757	244,668	United States 120,882; United Kingdom 104,145.
Silver:			
Ore and concentrate, metal content. thousand troy ounces	11,850	10,408	United States 5,304; Belgium-Luxembourg 1,552; Japan 1,357.
Refined metal do	12,221	13,736	United States 13,390; United Kingdom 248.

See footnotes at end of table.

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Table 2.—Canada: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Tin, ore and concentrate, long tons content.	337	325	United Kingdom 167; Mexico 127.
Titanium slag, 70 percent TiO_2[1]	115,651	133,552	All to United States.
Uranium U_3O_8[1]	653	96	Do.
Zinc:			
Ore and concentrate, metal content	536,438	667,420	United States 326,410; Belgium-Luxembourg 172,843; Japan 66,004.
Blocks, pigs, slabs	232,378	270,025	United Kingdom 113,901; United States 72,412.
Alloys, scrap, dross, etc	9,039	7,458	United States 4,517; Belgium-Luxembourg 1,760.
Fabricated materials, n.e.s	1,752	3,249	United States 2,851; United Kingdom 333.
NONMETALS			
Abrasives:			
Fused alumina, crude and grains	178,570	151,664	United States 138,240.
Silicon carbide, crude and grains	89,701	79,076	United States 77,768.
Asbestos:			
Crude	156	208	Japan 103; United States 43.
Milled fiber, all grades. thousand tons	1,312	1,217	United States 551; United Kingdom 100.
Barite, crude	180,578	132,542	United States 124,993.
Cement, portland	369,583	297,573	United States 297,553.
Clay and clay products. value, thousands	$9,245	$9,891	United States $7,406.
Feldspar	3,106	[1] 2,779	All to United States.
Fluorspar [1]	6,193	3,277	Do.
Gypsum, crude thousand tons	4,239	3,535	Do.
Lime	164,077	81,760	United States 79,517.
Limestone: Crude, crushed, and refuse	1,225,188	1,286,152	United States 1,286,072.
Nepheline syenite	239,154	279,062	United States 256,172.
Potash materials [1]	1,854,677	2,086,067	All to United States.
Salt value, thousands	$8,319	$5,482	Mainly to United States.
Sand and gravel	635,257	545,598	United States 545,420.
Silica, quartzite	141,555	50,984	All to United States.
Sodium sulfate	92,004	112,339	United States 109,551.
Stone, rough building and crude, n.e.s	201,200	91,257	United States 90,235.
Sulfur, crude and refined	1,269,232	1,609,048	United States 750,164; India 239,254; Australia 215,192.
Talc and soapstone [1]	3,259	4,533	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	1,114,761	1,214,127	Japan 1,058,735; United States 153,642.
Briquets, coal and coke	22,370	24,416	All to United States.
Coke, all types	79,487	76,143	Do.
Natural gas million cubic feet	426,224	505,165	Do.
Petroleum:			
Crude thousand 42-gallon barrels	123,691	150,345	Do.
Refinery products:			
Gasoline, total do	432	426	United States 420.
Distillate fuel oil do	346	1,415	United States 1,167; St. Pierre and Miquelon 248.
Residual fuel oil do	2,048	2,081	United States 2,078.
Lubricants do	42	45	United States 37.
Liquefied gases do	10,323	12,403	United States 10,173; Japan 2,224.
Other petroleum and coal products, n.e.s	2,874	2,727	Mainly to United States.

• Estimate. NA Not available.
[1] Data given are from United States Import Statistics.

Table 3.—Canada: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	2,290,347	2,323,582	Guyana 1,408,640; Surinam 699,980.
Alumina	732,858	690,126	Jamaica 384,261; United States 148,590; Guyana 105,158.

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Table 3.—Canada: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Aluminum—Continued			
Scrap aluminum and alloys	21,234	8,659	All from United States.
Pigs, ingots, shot, slabs, etc	15,353	7,418	United States 5,475; United Kingdom 1,163.
Semimanufactured products	55,681	75,201	United States 67,474.
Pipe, tubes, wire and cable	882	1,159	United States 1,054.
Manufactured materials. value, thousands	$8,726	$8,483	United States $7,181.
Antimony, oxide and salts, metal content	337	241	United Kingdom 182; mainland China 40.
Chromium, ore and concentrate, metal content.	18,942	31,285	United States 17,054; Philippines 6,977.
Copper:			
Ore, concentrate and scrap, copper content.	2,301	31,589	United States 30,842.
Blocks, pigs, ingots	9,518	4,817	All from United States.
Bars, rods, sheets, tubes, etc	1,976	1,399	United States 1,039; Japan 187.
Wire	150	194	United States 185.
Oxide and sulfate	384	599	United States 309; United Kingdom 266.
Alloys, primary and semimanufactured forms.	4,571	4,798	United States 2,930; United Kingdom 1,079; West Germany 673.
Iron and steel:			
Iron ore—thousand tons	4,392	2,439	United States 2,283; Brazil 110; United Kingdom 46.
Scrap iron and steel	651,099	511,352	United States 508,552.
Pig iron	29,443	26,075	U.S.S.R. 15,063; Finland 7,679.
Ferroalloys:			
Ferrochrome	11,372	19,722	Republic of South Africa 12,330; France 4,169.
Ferromanganese	44,559	14,555	Republic of South Africa 12,553; United States 1,847.
Silicomanganese	1,752	3,812	United States 2,083; Republic of South Africa 1,217.
Ferrosilicon	5,331	5,265	United States 4,137; Republic of South Africa 610.
Ferrotungsten	87	87	United Kingdom 52; Portugal 34.
Ferrovanadium	434	352	United States 219; U.S.S.R. 90.
Other	2,061	3,219	United States 2,056; Sweden 907.
Steel ingots and equivalent primary forms.	34,359	29,659	West Germany 14,801; United States 10,238.
Iron and steel products:			
Castings and forgings	95,931	80,481	United States 72,075.
Rolled steel, including structurals and rails.	1,110,516	1,034,726	United States 263,305; Belgium-Luxembourg 190,617; West Germany 169,015; Japan 129,034.
Pipe, tubes, wire and cable	251,012	259,110	Japan 76,090; United States 75,960; United Kingdom 51,616.
Lead:			
Primary and fabricated forms	774	674	United States 578; United Kingdom 80.
Oxide	1,364	2,214	Mexico 1,326; United States 544; United Kingdom 307.
Manganese:			
Ore and concentrate, manganese content.	167,015	74,987	Ghana 18,896; Congo (Kinshasa) 12,349; Brazil 10,543; Republic of South Africa 10,085.
Metallic manganese	2,414	2,018	Republic of South Africa 1,024; United States 566.
Magnesium metal	2,731	1,354	United States 1,297.
Mercury—76-pound flasks	5,324	4,688	Mexico 1,655; Spain 1,600; United States 636.
Molybdenum, molybdic oxide, gross weight.	302	205	All from United States.
Nickel, unwrought and semimanufactured, including alloys.	28,709	11,817	Norway 8,624; United States 2,657.
Platinum and group metals. troy ounces	197,853	212,889	United Kingdom 202,823.
Silver—thousand troy ounces	14,478	5,384	United States 5,371.
Sodium metal	6,855	7,717	United States 7,716.
Tin, blocks, pigs and bars—long tons	r4,254	4,548	Malaysia 2,886; Thailand 1,020; United States 636.
Titanium:			
Dioxide, pure and extended	10,343	10,323	United States 9,475.
Metallic titanium	1,288	1,966	United States 1,886.
Tungsten, in ore and concentrate	238	106	United States 64; United Kingdom 23; mainland China 10.

See footnote at end of table.

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Table 3.—Canada: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Zinc:			
Pigs, slabs, blocks, anodes	144	966	All from United States.
Bars, plates, sheets, discs, shells	999	724	Unitd States 589.
Fabricated materials	862	670	United States 645.
Dust and granules	1,181	1,099	United States 978; Belgium-Luxembourg 120.
NONMETALS			
Barite, ground	3,778	5,374	United States 5,262.
Bentonite, clay and drilling mud	174,371	199,455	United States 189,599.
Cement, all types	45,918	40,023	United Kingdom 15,257; United States 14,620; Japan 4,218.
Clays, ground or unground	301,463	290,439	United States 231,486; United Kingdom 58,928.
Cryolite, natural	3,312	2,795	Denmark 2,495; United States 300.
Diamonds:			
Unset thousand carats	68	73	Belgium-Luxembourg 42; Israel 18.
Industrial do	1,167	1,089	United States 760; Belgium-Luxembourg 133.
Dust do	232	295	United States 281.
Diatomaceous earth	26,508	30,235	United States 30,217.
Fluorspar	68,332	85,497	Mexico 71,692; United States 9,622.
Fuller's earth	6,915	8,236	All from United States.
Gypsum, crude	77,939	62,697	Mexico 58,513.
Lime	26,584	20,061	United States 19,912.
Magnesium compounds:			
Dolomite, calcined	15,628	9,467	All from United States.
Magnesia, dead burned	31,586	34,693	United States 28,239; Yugoslavia 3,754.
Mica, unmanufactured	2,889	3,168	United States 3,147.
Phosphate rock thousand tons	1,979	2,068	United States 1,947.
Phosphate fertilizers	105,847	149,345	United States 143,902.
Potash products, fertilizers	60,475	143,582	United States 90,987; West Germany 24,737; France 21,236.
Salt and brine	462,252	514,385	Mexico 212,628; United States 188,789; Bahamas 72,139.
Sand and gravel thousand tons	514	687	Mainly from United States.
Silica sand do	919	864	United States 860.
Sodium sulfate, and Glauber's salt	28,360	25,057	United States 16,080; United Kingdom 5,660; Belgium-Luxembourg 3,267.
Stone:			
Crushed, including stone refuse thousand tons	1,308	1,185	United States 1,180.
Cut (granite, marble, slate and other).	26,516	28,680	United States 19,430; Republic of South Africa 2,755.
Sulfur, elemental	131,963	113,199	United States 113,181.
Talc and soapstone	22,605	24,024	United States 22,929.
Vermiculite, crude	26,153	26,618	United States 21,885; Republic of South Africa 4,736.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bituminous materials, crude. value, thousands	$437	$348	United States $324.
Coal:			
Anthracite thousand tons	539	477	All from United States.
Bituminous and subbituminous. thousand tons	14,372	14,142	Do.
Briquets, coal and coke	5,972	7,701	Do.
Coke, all types (except briquets). thousand tons	983	864	United States 848.
Natural gas million cubic feet	43,551	52,872	All from United States.
Petroleum:			
Crude thousand 42-gallon barrels	146,077	170,785	Venezuela 103,345; Iran 20,550.
Refinery products:			
Gasoline, total do	2,791	5,182	Netherlands Antilles 2,558; Panama 746; Venezuela 525.
Kerosine and jet fuel do	4,419	7,910	Netherlands Antilles 3,552; Venezuela 2,480; United Kingdom 1,684.
Distillate fuel oil do	14,844	14,141	Venezuela 6,990; Netherlands Antilles 5,913.
Residual fuel oil do	30,471	37,110	Netherlands Antilles 15,445; Venezuela 10,586; United States 7,896.
Lubricants do	1,871	1,671	United States 1,442; Trinidad and Tobago 225.
Liquefied petroleum gases. do	84	281	Mainly from United States.
Other refinery products do	478	617	United States 372; Panama 84; Netherlands Antilles 72.
Other petroleum and coal products. value, thousands	$9,333	$8,531	United States $5,991; United Kingdom $1,068.

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COMMODITY REVIEW

METALS

Aluminum.—Following the production curtailment initiated in mid-1967, Canadian aluminum smelters resumed full-scale operation in September 1968 and achieved a record annual output in 1968. The year's output represented 90-percent capacity of the five reduction plants operated by Aluminum Company of Canada, Ltd. (subsidiary of Alcan Aluminium Limited),[4] and Canadian British Aluminium Company Limited (CBA). Reflecting recent expansion, annual capacity of these plants at mid-1968, was as follows:

Company and plant	Location	Metric tons
Alcan:		
Arvida	Quebec	338,000
Beauharnois	do	40,000
Alma	do	104,000
Shawinigan	do	64,000
Kitimat	British Columbia	236,000
Incremental additions.	All plants	80,000
CBA: Baie Comeau.	Quebec	104,000
Total Canadian capacity		966,000

The vast Alcan industrial empire includes nearly 100 subsidiaries and affiliates throughout the world. Product sales in 1968 totaled 1,107,000 tons, for which smelters in Canada provided 791,700 metric tons of primary metal. The raw materials for Canadian plants were supplied principally by Alcan Jamaica Ltd. in Jamaica and Demerara Bauxite Co. Ltd. in Guyana. Completion of the modernization program currently underway at the Alcan Canadian smelters will raise effective annual capacity to over 900,000 by 1972. CBA, in which an 83.5-percent interest was acquired in 1968 by Reynolds Metal Co. (United States), has also embarked on expansion that will raise primary aluminum annual capacity at the Baie Comeau smelter to about 160,000 tons in 1970.

Shipments of primary aluminum to domestic consuming industries were estimated at 200,000 metric tons in 1968. Exports of primary and semifabricated forms totaled 809,400 tons, principally to United States, United Kingdom, Japan, and Republic of South Africa.

Columbium, Tantalum, and Lithium.—The St. Lawrence Columbium and Metals Corporation near Oka, Quebec, has maintained a substantial production of columbium pentoxide (Cb_2O_5) from pyrochlore mining operations since 1961. This single mine ranks Canada as the world's third (after Brazil and Nigeria) largest source of the element. The bulk of production is exported to Europe and United States. In 1968, U.S. imports amounted to 134,211 kilograms.

Production of tantalum concentrate is scheduled to begin early in 1969, upon completion of mine preparation and construction of the 500-ton-per-day concentrating plant of Tantalum Mining Corporation of Canada, Ltd., at Bernic Lake, Manitoba. With reserves estimated at about 1.7 million tons averaging 0.23 percent Ta_2O_5 the operation is regarded as the Western Hemisphere's leading source. Apart from the anticipated recovery of tantalum, the company is also conducting studies aimed at commercial production of lithium and possibly beryllium minerals from the pegmatite bodies in the Bernic Lake vicinity.

Copper.—Under the stimulus of short supply, resulting from the 9-month, industry-wide strike in the United States that continued into April 1968, Canadian copper producers achieved new output records in 1968. Mine production was up 5,100 tons and refinery output up 25,000 tons above the 1967 levels. Value of production was about $13 million higher in 1968, reflecting the price to producers that held at Can$0.51 per pound for the first half of the year. On July 1 the price fell to Can$0.45.

Including the families of mines operated by Cominco, International Nickel, Falconbridge, and Hudson Bay Mining and Smelting Co., Ltd., Canada's copper mining industry in 1968 numbered over 90 mines. The Ontario mines, dominated by the nickel-copper companies (International Nickel, 10 mines; Falconbridge, eight mines), and the new Ecstall Mining Ltd. operation near Timmins, accounted for about 47 percent of the national output. About 25 mines in Quebec contributed 25 percent, and nine mines in British Colum-

[4] Both the Canadian subsidiary and the parent company are known as "Alcan."

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bia for 13 percent. In addition, of the two dozen new development prospects, 14 have announced firm plans to initiate production during 1969 and 1970. Noteworthy among the latter are the Brenda Mines Ltd. at Peachland, and Granduc Mines Ltd. at Unuk River, both in British Columbia, which expect to commence milling at respectively 22,000 and 6,000 tons per day. Lornex Mining Corporation Ltd., at Highland Valley, British Columbia, plans to start milling about 35,000 tons per day in 1972; and in the same area, Valley Copper Mines, 64 percent owned by Cominco, is conducting feasibility studies on a deposit said to contain 500 million tons of 0.5-percent copper ore.

Canada's six copper and copper-nickel smelters were rated a total annual feed capacity of 7.28 million tons of ores and concentrates. Annual capacity of the two copper refineries totaled 463,000 metric tons. Shipments of refined copper to domestic consumers amounted to 229,700 tons in 1968. Exports of refinery products, about half of which went to the United States and half to United Kingdom and European countries, totaled 250,944 tons. The bulk of Canada's exports of copper in ore and other crude forms, totaling 146,814 tons, went to Japan (102,158 tons).

Tonnage of primary copper consumed by domestic manufacturers of semifabricated products in 1966 (1965 in parentheses) went into the following: Copper rolled products including pipe, tube, etc., 66,536 (57,146); brass rolled products including pipe, tube, etc., 19,455 (10,232); wire and rod mill products 110,765 (103,914); and miscellaneous other products 1,015 (1,740).

Gold.—The declining trend in Canada's gold production continued through 1968. Five mine closures were recorded during the year, among which were the Hollinger Mines Ltd., Preston Mines Ltd., and the Teck-Hughes mine of Teck Corporation Ltd., all in Ontario; the San Antonio Gold Mines Ltd. in Manitoba; and the Tundra Gold Mines Ltd. in the Northwest Territories. Two new mines, Renabie Mines Ltd. in Ontario and Wasamac Mines Ltd. (No. 2) in Quebec, commenced production in 1968. Of the 35 gold mines that were operating at yearend, all but five were assisted under provisions of the Gold Mining Assistance Act.

Lode mines were credited with 80.9 percent of the Canadian total gold production in 1968. Recovery from base metal operations accounted for 18.8 percent, and small placer operations in British Columbia and Yukon Territory for 0.3 percent. Ontario, with 21 lode mines contributing, accounted for 50 percent of the national total in 1968. Nine gold mines and several base metal operations in Quebec accounted for 28 percent, and six gold mines in Northwest Territories for about 13 percent of the total.

Since adoption of the two-price system by the London Metal Exchange in March 1968, the Royal Canadian Mint has taken advantage of the open market prices that have ranged between $38 and $42. Gold sales by the Government and the several industry producers that are not subject to terms of the Gold Mining Assistance Act were estimated at about 2.2 million ounces in 1968.

Iron Ore, Pig Iron, and Steel.—Shipments of iron ore, concentrates, and pellets were at a record level in 1968, approximately 17 percent higher than in 1967. Including the four byproduct producers, 23 companies contributed to the year's output. The three large companies operating in the Quebec-Labrador (Newfoundland) region; Iron Ore Company of Canada, Ltd., Quebec Cartier Mining Co., and Wabush Mines, accounted for over 71 percent of the national total. Mines in Ontario supplied about 22 percent, and British Columbian mines produced over 4 percent. Exports totaling over 36 million tons in 1968 firmed Canada's position as the world's leading exporter of iron ore. Shipments to United States amounted to 27.1 million tons (23.9 million in 1967), and United Kingdom and Japan received 3.4 million and 1.9 million tons, respectively.

At the close of 1968, Canadian iron ore annual production capacity was rated at 48 million tons, of which 25.6 million represented pellet capacity. The industry included 19 companies that produced direct shipping ores, concentrates, and pellets, and four that recovered small quantities of iron byproducts from sulfide and titanium ores. Two small mines in British Columbia which exported magnetite concentrate to Japan—Jedway Iron Ore Ltd., on Vancouver Island and Brynnor Mines Ltd., on Moresby Island—closed in 1968.

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Table 4.—Canada: Salient iron and steel statistics

(Thousand metric tons)

	1964	1965	1966	1967	1968
Blast furnace feed:					
Iron ore:					
From Canadian mines	770	499	568	399	280
Imported	1,192	1,317	976	672	637
Sinter, pellets, etc.:					
From Canadian mines	2,133	2,791	3,857	4,717	7,358
Imported	3,341	3,455	2,712	2,097	1,657
Made in iron and steel plants	1,648	1,555	1,614	1,344	1,223
Blast furnace output:					
Pig iron	5,933	6,409	6,548	6,296	7,605
Ferroalloys	151	165	170	152	151
Steel furnace feed:					
Pig iron	5,131	5,575	5,734	5,529	6,695
Scrap	4,200	4,751	4,548	4,507	4,874
Steel furnace output:					
Ingots	8,136	8,950	8,903	8,665	10,078
Castings	147	148	171	130	129
Total	8,283	9,098	9,074	8,795	10,207
Rolled steel products:					
Carbon steel:					
Hot rolled	6,264	6,872	6,735	5,690	5,923
Cold rolled and coated	2,595	2,798	2,807	2,355	2,240
Alloy steel	264	335	358	363	396
Total	9,123	10,005	9,900	8,408	8,559

In Ontario, the Sherman Mine, a subsidiary of Dominion Foundries & Steel Ltd., near Timagami, and the Griffith Mine, owned by The Steel Company of Canada Ltd., at Bruce Lake, both started mining and pellet production in 1968. Capacities of the new plants are 1.1 million and 1.5 million tons of pellets annually.

Expansion programs of Iron Ore Company of Canada include virtually doubling the pellet production capacity of the Carol operation to 10 million tons per year, and raising the ship loading capacity at Sept-Isles from 8,000 to 15,000 tons per hour. In the Sudbury District expansion by The International Nickel Company of Canada Ltd. (Inco) and new construction by Falconbridge Nickel Mines Ltd. will provide annual capacity for respectively 1.1 million and 300,000 tons of byproduct iron ore pellets early in 1970.

Pig iron capacity of Canada's 15 blast furnaces and 11 electric furnaces at the close of 1968 totaled 8.69 million tons. Steelmaking facilities had a rated capacity of 11.90 million tons, distributed as follows: Basic open hearths 6.3 million, electric furnaces 1.7 million, basic oxygen furnaces 3.5 million, and steel foundries 400,000 metric tons.

Although dominated by the four fully integrated companies (Dosco Steel Ltd., Dominion Foundries & Steel Ltd., The Steel Company of Canada Ltd. and The Algoma Steel Corp. Ltd.), the Canadian steel industry, as of December 31, 1968, included seven producers of pig iron, 46 producers of steel ingots and/or castings, and seven ferroalloy manufacturers.

With the completion of recent expansion and modernization projects at several iron and steel plants, expenditures for new iron and steelmaking facilities were a relatively modest $107 million in 1968. Plans announced during the year call for substantial increases beginning in 1969. The Steel Company of Canada Ltd. has embarked on establishment of a completely integrated steel plant at Nanticoke, Ontario. Dominion Foundries & Steel Ltd., will invest about $60 million in a new blast furnace, increasing steelmaking and rolling mill capacities at Hamilton, Ontario; and a new blast furnace is to be built by Algoma Steel Corp. Ltd. at Sault Ste. Marie.

The pattern of raw material consumption by the iron and steel industry has changed materially since 1965 in favor of Canadian-made pellets. In 1965 domestic sources contributed but 41 percent of the national iron ore requirement, including 35 percent in the form of pelletized ore. The 1968 supply was 77 percent Canadian, including over 74 percent pelletized domestic ores.

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According to preliminary estimates Canadian consumption of steel, in terms of crude steel equivalent, approximated 9.70 million tons in 1968, compared with 9.19 million in 1967 and 10.74 million in 1965. Trade data for 1968 (1967 data in parentheses) show: Imports, pig iron 33,364 (26,075) tons; steel ingots and castings 8,785 (29,659) tons. Exports, pig iron 497,721 (440,615) tons; steel ingots and castings 270,571 (159,508) tons. For both imports and exports, United States traditionally has been the principal trading partner.

Ferroalloys.—While supplies of ferroalloys for manufacturing alloy steels were largely imported, substantial quantities of certain items were produced in plants of Union Carbide Canada Ltd. at Welland, Ontario, and Beauharnois, Quebec; Masterloy Products Ltd., near Ottawa; and Chromium Mining and Smelting Corporation Ltd. at Beauharnois. Consumption of ferroalloys by the steel industry in 1966 and 1967 was reported[5] as follows in metric tons:

	1966	1967
Ferroboron (B content)	25	5
Ferrochromium	15,600	16,835
Ferromanganese	62,015	55,943
Ferromolybdenum (Mo content)	156	170
Ferrophosphorus	589	513
Ferroselenium (Se content)	3	------
Ferrosilicon	34,168	31,576
Ferrotitanium (Ti content)	20	49
Ferrotungsten (W content)	64	5
Ferrovanadium (V content)	196	158
Ferrozirconium (Zr content)	19	9
Silicomanganese	15,025	17,155
Spiegeleisen	1,148	1,281
Others (ferrocolumbium, ferrotantalum, ferrochrome silicon, high manganese scrap, etc.)	7,443	5,314

Lead and Zinc.—Again in 1968 mine production of both lead and zinc set new records, lead up 6 and zinc 2 percent above the peaks established in 1967. Output of the refined metals, also at new highs, was up respectively 4 and 5 percent. The official 1968 lists, name 26 companies that produce lead and 34 that produce zinc, but the majority of these produce both metals, frequently with copper and precious metals. Regional mine sources of lead and zinc (the latter in parentheses) in 1968 were as follows: Newfoundland and Nova Scotia 6.9 (3.1) percent; New Brunswick 15.2 (11.4) percent; Quebec 0.9 (18.2) percent; Ontario 4.0 (29.5) percent; Manitoba and Saskatchewan 1.2 (6.4) percent; British Columbia 33.3 (12.8) percent. According to Department of Energy, Mines and Resources, the 37 mills that treated Canada's lead and zinc ores, in 1967, had a combined daily feed capacity of about 70,000 metric tons. The largest mills were those of Cominco Ltd. at Kimberley, British Columbia—9,100 tons per day; Ecstall Mining Ltd., Hoyle, Ontario—8,200 tons per day; Brunswick Mining & Smelting Corp. Ltd., Bathurst, New Brunswick—6,500 tons per day; and Hudson Bay Mining and Smelting Co. Ltd. at Flin Flon, Manitoba—5,400 tons per day. Refined lead is produced at the Tadnac smelter of Cominco Ltd., Trail, British Columbia, and in the new Imperial Smelting type blast furnace of East Coast Smelting and Chemical Co. Ltd. at Belledune, New Brunswick. The four zinc smelters and their annual capacity (metric tons) in January 1968 were as follows:

Canadian Electrolytic Zinc Ltd., Valleyfield, Quebec	127,000
Cominco Ltd., Trail, British Columbia	239,000
East Coast Smelting and Chemical Co. Ltd., Belledune, New Brunswick	88,000
Hudson Bay Mining and Smelting Co. Ltd., Flin Flon, Manitoba	72,000

During 1968, Pine Point Mines Ltd., the Cominco Ltd. subsidiary in Northwest Territories, added 2,700 tons per day capacity to its existing 4,500 tons per day Pine Point concentrator in anticipation of treating output from the recently acquired Pyramid property, beginning early in 1969. Half of the lead-zinc raw material supply to the Trail smelter in 1968 was derived from Pine Point concentrates. The Sullivan Mine at Kimberley, in southeastern British Columbia, supplied 41 percent, and 9 percent was derived from accumulated slags and residues and purchased ores. The smelter's output amounted to 172,600 tons of refined lead and 191,000 tons of zinc in 1968, compared with 170,000 and 183,000 tons respectively in 1967.

The first full year of operation at the Ecstall Mining Ltd., Kidd Creek Mine in Ontario yielded 510,200 tons of zinc concentrate and 87,000 tons of lead concentrate in addition to 186,000 tons of copper concentrate and 13.4 million ounces of contained silver. The output of this mine was primarily responsible for the Province

[5] Department of Energy, Mines and Resources, Mineral Resources Branch, The Canadian Mineral Industry in 1968, Preliminary (MR 97), Ottawa, Feb. 1969, p. 57.

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of Ontario increases of 29 percent in zinc and 254 percent in lead during 1968. The entire output of lead and zinc concentrates was exported.

Noteworthy among Canada's lead-zinc development projects is that of Anvil Mining Corporation Ltd. (controlled by Cyprus Mines Corporation) in the Vangorda Creek area, Yukon Territory. Annual production of about 220,000 tons of zinc concentrate and 130,000 tons of lead concentrate, all for export to Japan, is expected to begin late in 1969.

Apparent consumption of refined primary lead as determined by production and trade records in 1968 totaled 58,000 tons. Shipments of refined zinc to domestic consumers amounted to 113,000 tons. The great bulk of mine output of both metals is exported. Lead exports in 1968 at 256,401 (130,501 in ores and concentrates, 125,000 refined metal) were about 9 percent higher than in 1967. Zinc exports totaling 1,068,233 metric tons (779,107 in ores and concentrates, 289,126 in refined forms) were up 14 percent. Traditionally the major destinations for both metals have been United States, United Kingdom, and West European countries. Shipments of concentrates to Japan during 1968 contained about 33,000 tons of lead and 90,000 tons of zinc.

Mercury.—Following more than 20 years of inactivity, the Pinchi Lake mercury mine, near Fort St. James in British Columbia, was reopened and brought into production at a cost of about $10 million by Cominco Ltd. in August 1968. The concentrator and recovery plant is rated at 800 tons per day. Although production during the latter months of the year has not been officially reported, United States imports from Canada totaling 5,625 flasks were credited largely to the Pinchi mine source.

Molybdenum.—Production of molybdenum in 1968 fell slightly below that of each of the preceding 2 years. However, prices remained stable and development activities, particularly in British Columbia, continued at a high level. Four companies in Quebec accounted for 14 percent of the total output in 1968. All the remainder was from the copper-molybdenum producers in British Columbia.

British Columbia Molybdenum Ltd. contributed its first full year's production from the new 5,500-ton-per-day open pit mine and mill near Alice Arm, British Columbia. Brenda Mines Ltd., in the Peachland area, continued mine preparation and construction that is scheduled to start processing 22,000 tons of copper-molybdenum ore per day in 1969. The Brenda ore reserves have been estimated at 160 million tons averaging 0.18 percent copper and 0.03 percent molybdenum.

Among the several other molybdenum and copper-molybdenum prospects that are being investigated, two stand out. Plans of the Lornex Mining Corporation Ltd. call for investment of $110 million to provide an open pit operation at a daily rate of 35,000 tons of low-grade ore in the Highland Valley area of southwestern British Columbia. The Lornex orebody is estimated to contain 266 million tons averaging 0.43 percent copper, 0.014 percent molybdenum. Near Port Hardy, northern Vancouver Island, Utah Construction and Mining Co. (San Francisco, Calif.) conducted studies and is considering a 20,000- to 30,000-ton-per-day operation to exploit an orebody containing 163 million tons of ore grading 0.52 percent copper, 0.15 percent molybdenum.

Canadian exports of molybdenum in ores and concentrates in 1968 totaled 10,299 tons, of which 3,259 tons went to United Kingdom, 2,055 tons to Japan, and 2,832 tons to Netherlands and West Germany.

Nickel.—Output of nickel in 1968 was about 7 percent higher than in 1967 but slightly below the peak established in 1965. The higher price as indicated by Can$1.015 per pound for electrolytic nickel through most of the year, compared with Can$0.84 in 1965, accounted for the record value, exceeding $480 million, of nickel produced in 1968. The year's production was from 26 mines in Quebec, Ontario, Manitoba, and British Columbia. Eight mines operated by Falconbridge Nickel Mines Limited and 11 by The International Nickel Company of Canada Ltd. (Inco), all in the Sudbury District, were the principal contributors to Ontario's 77-percent share of the national production. The Inco mine at Thompson, and Sherritt Gordon Mines Ltd. at Lynn Lake accounted for Manitoba's 22-percent share. The two small mines at Belleterre and Malartic, Quebec, shipped concentrates to Sudbury, and the concentrates produced by Giant Mascot

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Mines Ltd., at Hope, British Columbia, were exported to Japan.

The three integrated nickel producers reported a total output of 263,605 metric tons of refined nickel and special forms in 1968. Company annual statements give annual production and proven ore reserve status, at yearend 1967 and 1968 as follows, in metric tons:

	1967	1968
Nickel production (deliveries):		
Inco	210,220	218,105
Falconbridge	33,909	32,074
Sherritt Gordon	11,376	13,426
Ore reserves, million tons:		
Inco	324.5	336.5
Falconbridge	50.5	51.1
Sherritt Gordon	10.8	11.4

During 1968, Inco continued its capital program that will add eight new mines and increase nickel producing capacity to around 540,000 tons annually by late 1971. Expenditures in 1968 amounted to $162 million. In addition work has begun on a $75 million nickel refinery at Copper Cliff that will employ a new process (Inco Pressure Carbonyl—IPC) to produce 100 million pounds and 25 million pounds of high-purity pellets and powders annually by 1971.

Falconbridge spent $35 million in 1968 on new mines and facilities. Two mines in the Sudbury District, Strathcona and Longvack South, started production during the year. The Strathcona mill, 7,000 tons daily capacity, was activated in February. To treat the concentrate from this mill additional smelting capacity was provided at Falconbridge in 1967. The new cargo ship M/V *Falcon,* carrying bulk cargoes of matte to the company's nickel refinery at Kristiansand, Norway, made three round trips late in the year.

A major portion of the Falconbridge expenditures in 1968 went into the iron ore concentrator that will produce 300,000 tons per year of iron-nickel pellets beginning in 1969. The product, expected to have a composition of 92 percent iron, 1.5 percent nickel, will be primarily for export. Under pressure of Provincial Government policy to refine Ontario mineral products in Canada, the company is considering construction of a nickel refinery in this country to replace the facility in Norway.

Sherritt Gordon Mines Ltd. reported capital expenditures of $9 million in 1968. Over $5 million of this went into plant and development of the Fox Mine, a copper-zinc project in northern Manitoba, being developed jointly with Japanese interests. A major effort during the year concerned research and testing of metallurgical processes for recovery of nickel and cobalt from laterite ores.

Domestic consumption of nickel for manufacture of alloy steels, coinage and plating amounts to about 9,000 tons annually. The great bulk of production is exported in semiprocessed and refined form. Trade statistics for 1968 report 87,000 tons of nickel in matte and similar unfinished materials largely to United Kingdom and Norway. Approximately 77 percent of the 119,000 tons of refined and fabricated forms went to the United States.

Silver.—With mine output 22 percent higher than in 1967, Canada became the world's leading silver producer in 1968. Half of the national total was produced in Ontario. About 3 million ounces was from the silver cobalt mines in the Cobalt-Gowganda area but most of the provincial output was from mines worked primarily for copper, lead-zinc, and nickel. Well over one-third of the Ontario total was credited to the Ecstall Mining Ltd. open pit copper-lead-zinc mine near Timmins. Since its opening in 1966, this operation has become the largest silver mine in the world. British Columbia's four producers, dominated by the Cominco Ltd. Sullivan Mine at Kimberley, accounted for 15 percent of the 1968 total. Most of the Yukon and Northwest Territories' 13-percent share was from the United Keno Hill Mines Limited in the Mayo District, Yukon Territory, and Echo Bay Mines Ltd. Port Radium property on Great Bear Lake. The Hudson Bay Mining and Smelting Co. Ltd. was the principal source of silver produced in the Prairie Provinces. About a dozen gold and base metal mines in Quebec accounted for 9 percent and in the Maritime Provinces' six producers, including Brunswick Mining & Smelting Corp. Ltd., in New Brunswick, and the American Smelting and Refining Company in Newfoundland contributed about 10 percent.

According to 1967 data, the source distribution of Canadian silver was 85.2 per-

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cent base-metal ores, 1.2 percent gold ores, and 13.6 percent silver and silver-cobalt ores.

Ten companies and the Royal Canadian Mint operate silver refineries in Canada. Output of these refineries, during the first 9 months of 1968, totaled 22.6 million ounces; however, this included large quantities of imported bullion and coins. In 1967 refinery production from domestic material was 20,824,158 ounces. The great bulk of this was recovered by Canadian Copper Refiners Ltd., Montreal East, Quebec (11,276,000 ounces); and Cominco Ltd., Trail, British Columbia (5,211,761).

Consumption of silver, most of which has been for coinage by the Mint, was 8.8 million ounces in 1968, compared with 14.6 million in 1967 and 21.3 million in 1966. In August 1968 the Mint suspended production of silver coins and began production of 5-, 10-, 25-, 50-cent and dollar denominations in pure nickel.

Exports of silver in 1968 amounted to 28.1 million ounces in refined form and 21.5 million ounces in ores and concentrates. Approximately 77 percent of the exported silver went to the United States.

Uranium.—Production of uranium oxide by the three companies active in the Elliot Lake region of Ontario and one in Beaverlodge, Saskatchewan, continued through 1968. Exploration activities and mine preparation to meet the anticipated market needs of the 1970's continued at a high pace.

A staking rush involving about 1,000 persons and recording of 2,500 new claims in the Elliot Lake area occurred when the Provincial Government, on February 19, 1968, reopened 100,000 acres that had been reserved pending consideration for use of the area as a provincial park, Intense prospecting interest was also evident in the Beaverlodge area of Saskatchewan, in several British Columbia localities, in northern Alberta and Manitoba, and in the Northwest Territories.

Investigation of prospects on the north shore of the St. Lawrence River continued during 1968 and considerable activity was generated in the vicinity of Lac Forestier-Ste-Ann du Lac, northeast of Mount Laurier, and in the Mistassini area, 420 miles north of Montreal, Quebec.

Foreign participation in Canada's uranium potential has included at least seven United States companies. In addition to long-term contracts for uranium oxide (U_3O_8) deliveries to Japan, a group of 15 Japanese firms has joined Kerr-McGee Corp. (United States) in exploratory drilling in the Elliot Lake area, and nine Japanese companies with Denison Mines Ltd. are conducting exploration in British Columbia.

Since 1965 when the Canadian Government authorized producers to negotiate sales contracts directly, agreements calling for delivery of over 33,000 tons of U_3O_8 over the years 1968 to 1983 have been signed. Rio Algom Mines Ltd. and Eldorado Nuclear Ltd. are committed to supply 6,900 tons to the Ontario Hydro-Electric Power Commission in the 1968–83 period. Rio Algom will also deliver 10,400 tons to the United Kingdom—UKAEA—in 1973–80. The several contracts with Japanese utility companies call for a total of 14,500 tons to be supplied by Denison, Rio Algom, and Eldorado in the 1969–79 period. Denison and Eldorado also contracted to deliver 1,300 tons to West German companies beginning in 1968. The small output of Stanrock Uranium Mines Ltd., since 1967, has been committed to a United States reactor manufacturer.

The Elliot Lake region accounted for about 75 percent of Canada's uranium production in 1968. Rio Algom suspended production at its Nordic mine around midyear and reactivated in October the Quirke mill on ore supplied by the New Quirke mine. Owing to unfavorable market outlook, the company decided, in the transfer, to discontinue recovery of thorium and rare-earth concentrates. In October, Rio Algom announced plans to spend about $24 million in reactivating mines and mills in the Elliot Lake region.

The Denison mill operated at about two-thirds of its 5,500-ton-per-day capacity throughout the year but suspended recovery of rare-earth products during part of this time. Stanrock Uranium Mines Ltd. continued its underground leaching operation with production at about 3 tons U_3O_8 per month through 1968.

Eldorado Nuclear Ltd., in the Beaverlodge area of Saskatchewan, operated at about 85 percent of its rated 1,800 tons daily capacity while conducting extensive underground development and providing facilities for treating custom ores.

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In addition to Rio Algom's recently announced plans in the Elliot Lake region several other operations currently under development are expected to come into production within the next few years. Agnew Lake Mines Ltd., 30 miles west of Sudbury, Ontario, is scheduled to start a 3,000-ton-per-day mill in 1972. The Consolidated Canadian Faraday Ltd. mine near Bancroft, Ontario, is being prepared for reactivation at a rate of about 1,000 tons per day. Eldorado Nuclear Ltd. is preparing the Hab mine, near Beaverlodge, Saskatchewan, for an output of 250 tons of ore per day that will be trucked to the Eldorado mill.

NONMETALS

Asbestos.—Approximately 86 percent of Canada's record output of chrysotile asbestos in 1968 was from mines of the seven companies situated in the eastern townships of Quebec. The original Cassiar Asbestos Corp. Ltd. mine at Cassiar in British Columbia and the company's new Clinton Creek Mine in Yukon Territory, accounted for 9 percent of the year's output. The remaining 5 percent came from Advocate Mines Ltd. at Baie Verte, Newfoundland, and from initial mill tests in Ontario, at the Reeves Mine (Johns-Manville Mining and Trading Ltd.) near Timmins, and Hedman Mines Ltd. at Matheson.

During 1968, Canadian Johns-Manville Co. Ltd. continued expansion of open-pit facilities aimed at increasing fiber output 90,000 tons annually by 1970. Asbestos Corporation Ltd. started construction of a new processing plant for the King-Beaver operation and announced plans for underground mining a deep-seated asbestos orebody. Bell Asbestos Mines Ltd. continued its shaft sinking project at Thetford Mines, and Lake Asbestos of Quebec Ltd. continued overburden removal to enlarge its open pit at Black Lake.

Milling tests and feasibility studies have continued at several new asbestos projects, notably those of McAdam Mining Corp. Ltd. at Chibougamau, Quebec, and Asbestos Corporation Ltd., at Asbestos Hill in the Ungava region.

About 95 percent of Canada's production is exported in a variety of grades of milled fiber. In 1968 exports totaled well over 1.3 million tons. Largest shipments were 600,000 to the United States, 108,000 to United Kingdom, 88,000 to Japan, and 82,000 to West Germany. The remaining 446,000 tons were distributed to over 60 other countries.

Potash.—Despite a world market oversupply and resultant drop in the Canadian price from Can$37.53 per ton K_2O equivalent in 1965, to a 1968 average of Can$25.58, last year's output was 21 percent higher than the 1967 peak. Reacting to the situation, some companies found it necessary to reduce their production schedules; nevertheless, in 1968 Canada became the world's second (to U.S.S.R.) largest producer and retained its position as the leading exporter of potash.

Although potash deposits are known in other parts of the Dominion, the deep-seated Prairie Evaporite Formation under southern Saskatchewan, containing 45 billion tons of potash ores, grading 25 to 35 percent K_2O equivalent, is the source of all Canadian production. Seven mines, including three that started during the year, accounted for the 1968 output. Two additional mines are scheduled to come on stream in 1969, and a third in 1971. Producers and prospective producers, all in Saskatchewan, are summarized as follows:

Company	Location	Year of first production	Annual capacity (thousand tons K_2O equivalent)	Type of mine	Depth of production bed (feet)
International Minerals & Chemical Corp. (Canada) Ltd. (2 mines).	Esterhazy	1962, 1967	1,910	Shafts 6 miles apart connected underground.	3,150
Kalium Chemicals Ltd	Belle Plaine	1964	410	Solution mining	5,200
Potash Company of America.	Saskatoon	1965	880	Underground, 2 shafts	3,815

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Company	Location	Year of first production	Annual capacity (thousand tons K_2O equivalent)	Type of mine	Depth of production bed (feet)
Allan Potash Mines	Allan	1968	820	Underground, 2 shafts	3,409
Alwinsal Potash of Canada Ltd.	Lanigan	1968	540	Underground, 1 shaft	3,280
Duval Corp	Saskatoon	1968	540	Underground, 2 shafts	3,815
Cominco Ltd	Vanscoy	(1969)	650	Underground, 2 shafts	3,532
Noranda Mines Ltd	Viscount	(1969)	820	Underground, 2 shafts	3,350
Sylvite of Canada Ltd	Rocanville	(1971)	540	Underground, 2 shafts	3,300

Source: Department of Energy, Mines and Resources.

According to the Dominion Bureau of Statistics, domestic consumption of potash for fertilizer manufacture has increased from about 81,000 tons (K_2O equivalent) in 1960 to 109,000 in 1964 and 162,000 tons in 1967. The great bulk of production is exported, largely to parent company affiliates in the United States. Of the reported $88.9 million total value of potash exports in 1968, value of shipments to United States amounted to $58.2 million, Japan ($11.5 million) and the Netherlands ($10.0 million).

Sulfur.—Canada is recognized as the world's largest producer of sulfur from hydrocarbon sources and in 1968 surpassed the United States to become the world's leading exporter of elemental sulfur. The great bulk of Canadian production is recovered in Alberta from sour natural gas. A small quantity of elemental sulfur is also extracted from domestic and imported crude petroleum at refineries located through the Dominion. In addition to these hydrocarbon sources which accounted for 78.1 percent of total sulfur production in 1968, sulfuric acid made during the year from stack gasses at Canadian smelters contained 513,191 tons, and pyrite and pyrrhotite concentrate shipments contained 144,275 tons of recoverable sulfur.

At yearend 1968 the sour natural gas industry numbered 28 sulfur recovery plants, of which six came on stream during the year. Total rated capacity of these plants was 12,600 tons elemental sulfur daily.

A recent report[6] by the Canadian Petroleum Association summarizing technological and geological data related to the national hydrocarbon resources places Alberta's sulfur recovery potential at 1,148 million metric tons. Ultimate recoverable sulfur content of Alberta's sour gas reserves are credited with 355 million and Athabasca type oil sands with 793 million metric tons. Proved reserves of sulfur in the 29 major sour gasfields of Alberta (December 31, 1967) were estimated at 110.7 million tons.

Consumption of sulfur by Canadian manufacturers of pulp and paper, chemicals, fertilizer, and numerous other industries, amounted to about 1.3 million tons in 1967. The record exports of 1968 totaled 1.9 million tons, of which over 834,000 tons went to United States, 294,000 to Australia, 223,000 to India, and the balance to 17 other countries.

MINERAL FUELS

Coal.—As a result of lower production from mines in Nova Scotia, New Brunswick, and British Columbia, Canadian output of coal in 1968 fell below the 11-million-ton level. However, developments during the year mark it as a turning point of major importance to the coal mining industry. Contracts negotiated by five Canadian firms with Japanese steel companies in 1967 and 1968 provide a firm long-term market for high-grade coking coal from Alberta and British Columbia during the 1969–85 period. Department of Energy, Mines and Resources analysts anticipate exports to Japan at 6 million tons in 1970 and over 9 million tons annually beginning in 1971. Principal Canadian participants in these coal deals were as follows:

[6] Canadian Petroleum Association. Potential Reserves of Oil, Natural Gas, and Associated Sulfur in Canada. Calgary, Alberta, April 1969, 25 pp.

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Company	Location	Contract Period (years)	Contract Quantity (million tons)	Contract Value (millions)
Alberta:				
Coleman Collieries Ltd.	Coleman	15	13.2	$160
Canmore Mines Ltd.	Canmore	10	3.9	70
Cardinal River Coals Ltd.	Luscar	15	15.2	200
McIntyre Mines Ltd.	Smoky River area	15	30.5	400
British Columbia:				
Kaiser Coal Ltd.	Natal-Fernie area	15	45.7	650
Total			108.5	1,480

Among the several prospective deals being considered early in 1969 was that of the Fording River Coal Company to supply Japanese markets with about 3 million tons annually for 15 years from open pit mines north of Natal, British Columbia.

Under the program of Federal and Provincial Government assistance to coal mining in Nova Scotia, the Cape Breton Development Corporation (DEVCO) acquired four of the Province's 10 producing collieries. The acquired mines were those of Dominion Steel and Coal Corp. (DOSCO) in the Sydney Coal Field. DEVCO also assumed management of the McBean mine in Pictou County which had been scheduled for closure. Five independent mines continued to operate without Federal assistance after March 31, 1968, but were dependent upon the Nova Scotia Government for any assistance the Province deemed necessary to maintain coal supplies to provincial electric plants.

Responsibility for rationalization of mines in the Minto area of New Brunswick was assumed by that Province in March 1968, under the Grand Lake Dvelopment Act. The agreement called for termination of Federal aid to the mines but provided a grant of Can$19.6 million to be paid to the Province over a 4-year period. As in Nova Scotia, a major part of the Minto production is required to supply thermal-electric utilities.

Canada's national coal balance for recent years is summarized as follows:

	Million metric tons 1965	1966	1967
Production	10.5	10.3	10.3
Imports:			
Anthracite	.6	.6	.5
Bituminous	14.2	14.2	13.9
Total available	25.3	25.1	24.7
Consumption	23.4	23.6	22.7
Exports	1.1	1.1	1.2

Source: Dominion Coal Board and Dominion Bureau of Statistics.

Principal statistics for the Canadian coal mining industry in 1967, as compiled by Dominion Bureau of Statistics[7] (corresponding data for 1966 in parentheses), were as follows: Number of mines, 65 (72); average number of employees, 8,227 (8,564); value of production, f.o.b. mines, $76.6 million ($75.4 million); average productivity in metric tons per man-day, total, 5.22 (4.70); from strip mines, 21.32 (18.28); from underground mines, 2.88 (2.82).

Subvention payments for the 1967–68 fiscal year, April 1 to March 31 (1966–67 in parentheses) were reported by the

[7] Dominion Bureau of Statistics. The Coal Mining Industry for Calendar Year 1967. Cat. No. 26–206 (annual), November 1968, pp. H–14, H–22.

Table 5.—Canada: Coal consumption by use

Consumer	1964	1965	1966	1967	1968 p
Total consumption, thousand metric tons	23,478	24,500	23,653	23,936	24,353
Household, percent	13.0	10.7	9.0	7.2	7.7
Power and industrial, do.	56.5	60.4	60.4	62.5	62.2
Coke and gas, do.	22.7	21.8	22.5	22.2	22.2
Transportation, do.	2.3	2.1	2.4	1.9	1.8
Colliery and waste, do.	.6	.5	1.0	1.1	.9
Export, do.	4.9	4.5	4.7	5.1	5.2

p Preliminary.

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Dominion Coal Board[8] as follows: Tonnage to which applied, 4.83 million metric tons (5.82 million); total cost, $30.8 million ($34.9 million); cost per ton, $6.38 ($5.99).

Petroleum and Natural Gas.—Canadian production of crude oil and natural gas liquids at a daily rate of 1.19 million barrels, and natural gas withdrawals averaging 4.45 billion cubic feet per day set new production records in 1968. With production of both oil and gas largely controlled by U.S. markets, the year's output reflects a 13-percent increase in value of crude oil and a 19-percent increase in natural gas exports over the 1967 levels. In 1968 Alberta accounted for about 75 percent of the $1.18 billion value of Canada's oil and gas production. Saskatchewan and British Columbia contributed 17 percent and 6 percent, respectively, and the combined output of the Northwest Territories and three eastern provinces accounted for the remaining 2 percent.

Exploration and development drilling expenditures totaled $592 million in 1968, compared with $555 million in 1967. As in recent years over 95 percent of this activity was in Western Canada. Throughout the Dominion survey crews spent a total of 1,033 crew-months in the field. A total of 13,793,224 feet was drilled in 3,149 completed wells, of which 7.5 million feet in 1,570 wells was classified as exploratory and/or stratigraphic drilling. Offshore drilling in 1968 totaled 80,822 feet in eight holes, all off Vancouver Island, British Columbia.

Drilling around the peripheries of the Rainbow Lake-Zama Lake area in northwestern Alberta has uncovered two new oil pools and a new major discovery of sour gas was reported in the Clarke Lake area of central Alberta. The Prudhoe Bay discoveries and boom activity in Alaska generated interest in Canada's arctic regions. Imperial Oil Ltd., British American Oil Co. Ltd., and Shell Canada Ltd. are drilling on Richards Island in the Mackenzie River delta. Panarctic Oils Ltd., the Government-sponsored consortium of 20 companies, is scheduled to start drilling on Melville Island (75° north latitude) in the spring of 1969. Offshore areas are being investigated on both sides of the continent, notably off British Columbia, where Shell Canada Ltd. completed a 10-well geological drilling program off the west coast of Vancouver Island.

The Alberta Government early in 1968 relaxed restrictions imposed on Athabasca bituminous sands, raising the allowable production rate of 45,000 barrels per day to 150,000 barrels, and entertained a reapplication of Syncrude Canada Ltd., to establish a project similar to that of Great Canadian Oil Sands Ltd. near Fort McMurray.

According to estimates by the Canadian Petroleum Association, proved reserves of crude oil and natural gas liquids at yearend totaled 10,018 million barrels. Gains of 131 million barrels were credited to 1968 discoveries, 518 million to revisions of earlier estimates and 254 million to field extensions. Proved marketable reserves of natural gas were placed at 47,666 billion cubic feet, with gains of 283 billion, 230 billion, and 2,867 billion cubic feet credited respectively to the year's new discoveries, revisions and field extensions. A special Geological Reserve Committee of the Canadian Petroleum Association, early in 1969, reported a study of ultimate recoverable oil and gas reserves in inland and offshore sedimentary basins in the light of productive histories and present recovery techniques. The committee findings[9] indicate Canadian potential recoverable reserves of hydrocarbon materials as follows:

Crude oil	billion barrels	120.8
Natural gas liquids	do	19.6
Raw natural gas	trillion cubic feet	724.8
Tar and oil sands (oil yield)	billion barrels	445.8

[8] Dominion Coal Board. Twentieth Annual Report, 1967–68. Ottawa, Canada, 1968, p. 26.
[9] Work cited in footnote 6.

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The Mineral Industry of Chile

By Garn A. Rynearson[1]

The Chilean mineral industry in general performed well during 1968 while the country slowly recovered from the economic slump of 1967. Progress in many sectors of the economy, including some mineral industry sectors, was impeded by unprecedented drought conditions in the central and northern regions. Another factor contributing to slow overall economic recovery was the rash of strikes arising from political unrest and continued inflation, resulting in the loss of more than 4 million man-days of work compared with the loss of slightly less than 2 million man-days in 1967.

New construction, both public and private, was discouraged by the conditions that prevailed, and it was not until the latter part of 1968 that the construction industry began to recover notably from the very low level to which it fell in 1967. Construction-oriented industries that produced primary metals, cement, cement and asbestos products, brick, and wood for domestic use suffered accordingly.

Preliminary data indicate output of mine copper and byproduct molybdenum both declined from the levels of 1966 and 1967. However, the high price of copper in the world market resulted in greatly increased revenue for the Government as well as the producers, and helped Chile to build up international reserves of $129.2 million in 1968.

Chile continued to produce a significant amount of iron ore for export as well as for domestic consumption; however, the average unit value of ore exported declined from $6.94 to $6.81 per metric ton. While Chile remained the only significant source of natural nitrates, the production and export of both sodium and potassic nitrate continued to decline as the industry found it increasingly difficult to maintain large-scale operations based only on the recovery of nitrates and byproduct iodine. The possibility of recovering other valuable byproducts from the mineral rich caliche was being investigated as a possible means of reviving the industry. In the meantime, Chile's output of iodine during 1967 and 1968 was exceeded by that of Japan, which replaced Chile as the world's leading producer. Although not particularly significant by world standards, the production and

[1] Physical scientist, Division of International Activities.

Table 1.—Chile: Selected economic indicators

Indicator	1966	1967	1968
Population at midyear, in thousands [1]	8,879	9,057	9,232
Gross national product (GNP): [1]			
Total GNP, in million 1967 dollars [2]	5,343	5,426	p 5,600
Percent change from previous year	+6.1	+1.6	p +3.2
GNP per capita, in 1967 dollars	602	599	607
Index of industrial production (1960 = 100): [3]			
Average by Sociedad de Fomento Fabril	164.1	166.3	169.1
Percent change from previous year	+9.5	+1.3	+1.7
Consumer price index, percent above previous year [4]	17.0	21.9	27.9

p Preliminary.
[1] U.S. Agency for International Development. Economic Data Book for Latin America: Chile. October, 1969, p. 5.
[2] Converted from Chilean escudos at estimated effective rate of 5.79 escudos per U.S. dollar.
[3] Banco Central de Chile. Boletin Mensual. No. 494, Apr. 1969, p. 403.
[4] Banco Central de Chile. Boletin Mensual. No. 494, Apr. 1969, p. 518.

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export of high-quality rock salt from northern Chile increased markedly during 1968 and was rapidly becoming an important factor in the local economy.

Important expansion and development projects were underway or in advanced stages of planning in virtually all major sectors of the industry. The considerable growth of the mineral industry during 1968 was not reflected in production and trade statistics, however, and was partly obscured by the attention given to the drought, strikes, and political issues. It was estimated that more than $1,000 million was committed for investment in major mining ventures and other industrial projects involving the processing of minerals and metals. The estimate included the investment of $776 million in only four of numerous projects in copper mining or refining, $25 million for two projects in iron ore production, $75 million or more in expansion of the nation's only large steel mill, $25 million for two projects involving steel products, $25 million in the nitrate industry, $61 million in four petrochemical projects, $15 million in a natural gas processing project, and $2.5 million to increase the capacity of one petroleum refinery.

PRODUCTION

The relative productivity of different sectors of the mineral industry varied widely according to the extent their operations were affected by the drought, by strikes, or by unusual variations in demand for certain commodities produced for domestic consumption. The production of copper and byproduct molybdenum was inhibited by effects of the drought. The nitrate-iodine industry was hard-hit by labor troubles while seeking to eliminate chronic operational losses by reorganization of management and introduction of technological innovations. The steel industry was adversely affected by labor problems as well as the slow recovery of consumer demand following the economic slump of 1967. On the other hand, iron ore producers were relatively unaffected by either drought or strikes, and all major companies returned to more normal operations after having their production curbed by strikes in 1967. The most impressive performance during the year was registered by the petroleum industry which increased crude oil output 10.7 percent and achieved a new production record. In addition, the industry's refineries substantially increased output of fuels that were sorely needed to help compensate for energy losses resulting from drought-caused restrictions on generation of hydroelectric power.

Table 2.—Chile: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Copper:					
Mine output, metal content [2]	663,343	605,908	663,561	663,478	661,841
Metal, copper content:					
Blister [2]	308,998	285,891	288,985	314,297	312,061
Refined [4]	278,076	288,878	342,796	316,068	315,403
Gold, mine output, metal content, troy ounces	64,993	58,897	[r] 69,626	58,135	53,145
Iron and steel:					
Iron ore and concentrate, thousand tons	9,853	12,145	[r] 12,212	10,783	11,917
Pig iron, do	437	309	433	498	442
Ferroalloys, do	10	13	12	10	NA
Steel ingots and castings, do	584	477	577	631	570
Semimanufactures (rolled products), do	[r] 462	391[r]	486	451	NA
Lead, mine output, metal content	1,116	783	827	404	990
Manganese ore and concentrate	19,861	16,587	17,921	14,846	23,549
Mercury, 76-pound flasks	267	435	96	184	513
Molybdenum, mine output, metal content	3,807	3,693	[r] 4,641	4,740	3,865
Silver, mine output, metal content, thousand troy ounces	3,097	2,972	[r] 3,198	3,156	3,757
Zinc, mine output, metal content	1,005	1,383	[r] 1,348	1,123	1,255

See footnotes at end of table.

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Table 2.—Chile: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
NONMETALS					
Barite	1,091	2,841	[r] 2,127	4,504	3,986
Boron materials, crude, ulexite	3,314	4,602	[r] 4,703	--------	--------
Cement, hydraulic thousand tons	1,267	[r] 1,188	1,364	1,235	1,251
Clays:					
Kaolin	45,963	30,675	[r] 40,425	29,424	25,951
Other	29,968	42,619	[r] 87,751	91,685	81,992
Diatomite	NA	129	[r] 571	29	--------
Feldspar	827	525	[r] 1,193	871	935
Fertilizer materials, crude natural:					
Nitrates:					
Sodium thousand tons	1,070	1,050	945	762	623
Potassium enriched do	104	109	117	107	56
Phosphates:					
Apatite	13,138	10,074	--------	--------	NA
Guano	15,051	21,806	15,753	16,307	22,612
Fluorspar, all grades	NA	NA	215	455	--------
Gemstones, lapis lazuli kilograms	16,500	20,265	--------	[r] --------	8,200
Gypsum:					
Crude	119,160	101,107	[r] 120,070	132,547	119,106
Calcined	44,063	65,232	[r] 49,379	42,448	49,996
Iodine, elemental	2,161	[r] 2,281	2,931	2,216	1,964
Pigments, natural mineral, iron oxide	NA	NA	29,199	19,762	15,062
Pozzolan	141,417	140,992	145,414	134,177	156,391
Quartz:					
Common quartz	119,111	127,195	[r] 156,060	146,954	112,786
Glass sand	NA	NA	1,272	3,341	31,571
Salt, all types	93,959	99,691	[r] 202,681	417,789	841,247
Stone, not further described:					
Dolomite	NA	NA	3,307	233	--------
Limestone thousand tons	1,923	1,784	[r] 2,238	1,920	2,038
Marble	NA	NA	3,137	982	2,200
Sulfur:					
Native, other than Frasch:					
Refined, sulfur content	41,146	33,369	37,283	45,710	42,311
Unrefined (caliche), sulfur content	2,732	1,596	2,388	10,259	20,174
Sulfur content of acid derived from pyrite and industrial gases	15,675	10,635	11,458	12,187	12,122
Sulfates, natural, sodium	30,685	41,488	[r] 35,135	17,747	17,880
Talc	2,760	4,374	[r] 2,552	2,881	2,813
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous and lignite thousand tons	1,789	1,727	1,652	1,496	1,580
Coke:					
Oven do	246	213	[r] 231	287	NA
Gashouse do	83	[e] 81	[r e] 75	[e] 73	NA
Gas, natural:					
Gross production [5] million cubic feet	221,822	219,468	234,954	248,597	246,784
Sold to consumers [5] do	--------	--------	--------	318	528
Treated in plants [5] do	168,950	157,063	157,798	158,887	153,597
Injected [5] do	158,939	158,409	179,024	188,555	178,470
Natural gas liquids, gross production:					
Condensate thousand 42-gallon barrels	1,542	1,390	1,348	1,292	1,216
Natural gasoline do	509	472	497	483	499
Liquefied petroleum gases [6] do	1,532	1,482	1,527	1,498	1,468
Petroleum:					
Crude oil do	13,687	12,703	12,428	12,369	13,695
Refinery products: [r 7]					
Gasoline and naphthas:					
Aviation gasoline do	416	320	284	283	226
Motor gasoline do	6,153	6,441	7,296	8,241	8,575
Naphthas do	--------	5	148	140	187
Kerosine do	1,915	1,879	2,043	2,330	2,491
Distillate fuel oils do	3,105	3,071	3,686	4,012	4,736
Residual fuel oil do	4,847	4,492	6,540	7,883	8,538
Liquefied petroleum gas do	469	543	795	1,657	1,697
Asphalt, refinery do	--------	7	6	31	41
Solvents do	99	106	121	130	122
Other, n.e.s do	18	43	66	83	116

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to commodities listed, Chile also produces unreported amounts of selenium, mica, and manufactured gas.

[2] Figures shown represent the nonduplicative copper content of ores, concentrates, precipitates, metal, or other copper-bearing products, measured at the least stage of processing represented in available statistics.

[3] Data for 1964–65 represent blister produced for export, whereas data for 1966–68 include blister produced for export as well as unspecified quantities of blister produced and retained in Chile for refining at the Las Ventanas electrolytic refinery.

[4] Data for 1966–68 exclude electrolytic copper produced at the Las Ventanas refinery in order to avoid double counting of some copper included in data shown for blister.

[5] Converted from cubic meters at rate of 1 cubic meter equals 35.3145 cubic feet.

[6] Data apparently represent net plant output for consumption, and are presumed to exclude reinjected quantities as follows, in thousand 42-gallon barrels: 1964–73; 1965–88; 1966–49; 1967–36; 1968–19.

[7] Data represent gross output of finished products, including quantities consumed by Empresa Nacional del Petróleo for refinery fuel and other purposes.

Sources: Servicio de Minas del Estado, Dirección de Estadística y Censos, Instituto Latinoamericano del Fierro y el Acero, and Empresa Nacional del Petróleo.

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TRADE

The considerable importance of exportable mineral commodities to Chile's economy is indicated by the predominance of their share in the country's substantial export earnings. Exports of mineral commodities represented 89.3 percent of the total value of all exported goods in 1966 and 93.7 percent in 1967. Copper in various processed and unprocessed forms was by far the most important export commodity, as it accounted for 72.8 percent of 1966 exports and 78.6 percent of 1967 exports. In sharp contrast to outflowing trade, imports of mineral commodities represented only about 15 percent of total imports for 1966 and 1967.

The total value of mineral commodities exported in 1967 was 8.8 percent higher than the value of such exports in 1966. The increase was primarily due to the greater quantity and higher unit value of refined copper exported, for the quantity and value of most other major export commodities (including iron ore, nitrates, iodine, and silver ore and concentrates) declined in 1967. Preliminary data for 1968 indicate a somewhat smaller increase in the value of mineral commodities exported, with the net gain being due mainly to higher unit prices obtained for copper which resulted in a greater return on the smaller quantity sold. Modest increases were indicated in the value of iron ore and salt exported, but exports of nitrates, iodine, molybdenum, and iron and steel all declined in 1968.

Although the total value of mineral commodities imported during 1967 was only 3.2 percent less than that during 1966, there were significant variations in the relative values of the principal imports in each of the three categories. The value of crude petroleum imported increased $11.6 million whereas imports of iron and steel semimanufactures decreased $15.3 million and those of fertilizer materials decreased $3.6 million. A slight decrease in crude petroleum imports was indicated for 1968, but preliminary estimates suggest increases in coal and fuel oil imports were substantial.

A tabulation comparing trade in mineral commodities by major categories and total trade follows:

	Value (million dollars)	
	1966	1967
Exports:		
Mineral commodities:		
Metals	751.6	830.0
Nonmetals	34.4	25.8
Mineral fuels	.9	1.0
Total	786.9	856.8
All commodities, total	880.8	913.7
Imports:		
Mineral commodities:		
Metals	35.2	23.5
Nonmetals	31.4	25.2
Mineral fuels	47.0	61.3
Total	113.6	110.0
All commodities, total	750.6	722.4
Net trade balance:		
Mineral commodities	+673.3	+746.3
All commodities, total	+130.2	+191.3

Preliminary trade data for 1968 estimated total value of exports at $970 million and the value of imports at $734.2 million, indicating increases of 6.2 percent in exports and 1.6 percent in imports compared with totals registered for 1967.

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Table 3.—Chile: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	8	2	Mainly to Peru.
Copper:			
Ore and concentrate	10,939	17,904	West Germany 13,125; Spain 2,518.
Slag, ash, and residues	757	616	All to Sweden.
Sulfate	114	388	Mainly to Brazil.
Oxide	242	-------	
Metal, including alloys:			
Unwrought:			
Unrefined:			
Precipitates, including cement.	18,314	25,448	Japan 16,010; West Germany 5,667.
Blister	239,212	246,984	United States 126,925; West Germany 33,360; United Kingdom 31,595; Belgium-Luxembourg 31,592.
Refined	323,296	371,506	Netherlands 74,736; United Kingdom 65,997; Italy 59,895; France 40,338.
Master alloys	29	2	All to United States.
Semimanufactures	r 29,378	9,652	Venezuela 2,818; Italy 1,214.
Gold, ore and concentrate	14,423	20,736	Japan 14,026; Poland 4,010.
Iron and steel:			
Ore and concentrate—thousand tons	11,095	9,894	Japan 8,175; United States 1,322.
Slag	(1)	1,869	All to United States.
Metal:			
Pig iron, cast iron, and similar materials.	-------	5,058	All to Mexico.
Ferroalloys:			
Ferromanganese	3,658	1,458	United States 715; Colombia 330; Brazil 309.
Ferromolybdenum	659	475	West Germany 265; Poland 82.
Other	1,575	302	Mainly to Colombia.
Steel, primary forms	-------	33,114	Mexico 10,331; Japan 9,777; Peru 6,981.
Semimanufactures	r 10,062	56,056	Argentina 20,731; Peru 13,789; Japan 9,352.
Manganese, ore and concentrate	2,440	6,397	West Germany 3,349; United States 3,048.
Molybdenum:			
Concentrate	6,512	7,316	West Germany 2,139; United Kingdom 1,791; Sweden 1,221.
Oxide, all grades	802	1,455	Japan 512; West Germany 349; France 286.
Nickel, metal, scrap	-------	31	All to West Germany.
Silver:			
Ore and concentrate	37,247	33,419	Japan 24,960; West Germany 8,459.
Metal—troy ounces	-------	70,217	West Germany 41,924; United Kingdom 28,293.
Zinc:			
Ore and concentrate	-------	2,079	Belgium-Luxembourg 1,074; West Germany 1,005.
Scrap, ash, residues	349	249	All to Belgium-Luxembourg.
NONMETALS			
Boron materials, crude natural borates	90	60	All to Argentina.
Cement	2,554	500	All to Peru.
Iodine	3,384	2,344	United States 1,064; Netherlands 739; United Kingdom 383.
Fertilizer materials, crude natural nitrates:			
Sodium	743,601	518,999	United States 186,675; Netherlands 90,062; Spain 66,441.
Potassium enriched	107,040	98,937	United States 71,305.
Precious and semiprecious stone, lapis lazuli. kilograms	6,382	3,681	Italy 1,586; United States 797; West Germany 480.
Salt	96,183	258,895	Japan 164,616; United States 94,279.
Other nonmetals, n.e.s.—value	$34,838	$1,603	All to Ecuador.
MINERAL FUELS AND RELATED MATERIALS			
Coal	1,032	800	All to Bolivia.
Natural gas liquids	30,104	37,928	All to Argentina.
Other mineral fuels and related materials, n.e.s. value	$18,084	$352	Mainly to Bolivia.

r Revised.
1 Less than ½ unit.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1966 and 1967.

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Table 4.—Chile: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite and concentrate	1,543	11
Oxide (alumina) and hydroxide	22	257
Metal, including alloys:		
Scrap	73	36
Unwrought	2,877	4,074
Semimanufactures	459	1,026
Antimony, metal	65	28
Arsenic:		
Trioxide, pentoxide, and acids	87	120
Metal	----	5
Bismuth, metal	2	(2)
Cadmium, metal	2	5
Chromium:		
Chromite	----	16
Oxides and hydroxides	60	48
Metal	178	----
Copper:		
Ore and concentrate	----	55
Metal, including alloys, all forms	519	117
Gold, metal, unworked or partly worked troy ounces	55	101
Iron and steel:		
Pig iron, including spiegeleisen	20,659	895
Sponge iron, powder, and shot	16	124
Ferroalloys:		
Ferromanganese	(2)	1,486
Other	309	335
Ingots and other primary forms	----	203
Semimanufactures:		
Bars and rods	9,073	2,376
Angles, shapes, sections	6,669	4,209
Universals, plates, sheets	76,378	3,590
Hoop and strip	530	509
Rails and accessories	8,642	8,487
Wire	1,515	778
Tubes, pipes, fittings	26,358	9,876
Castings and forgings, rough	393	1,436
Lead:		
Oxides	2	15
Metal, including alloys:		
Scrap	(2)	47
Unwrought	1,680	855
Semimanufactures	1,189	670
Mercury—76-pound flasks	395	5
Nickel:		
Matte, speiss, and similar materials	----	16
Metal, including alloys, all forms	127	93
Platinum-group metals, including alloys, all forms troy ounces	433	294
Selenium, elemental kilograms	----	963
Tin:		
Oxides	----	10
Metal, including alloys, all forms—long tons	951	950
Titanium:		
Ore and concentrate (rutile)	----	74
Oxides	2,015	2,087
Zinc, metal, including alloys:		
Scrap and blue powder	95	(2)
Unwrought	4,170	6,573
Semimanufactures	244	70
Zirconium, ore and concentrate	----	234
Other:		
Ore and concentrate, n.e.s.—value	$23,475	$68,783
Ash and residue containing nonferrous metal value	----	$9,236
Oxides, hydroxides, and peroxides of metals, n.e.s.—value	$45,864	$63,216
Metals, including alloys, all forms, n.e.s.—value	$107,905	$214,519
NONMETALS		
Abrasive stone, powder, and grain, n.e.s.	783	429
Asbestos	7,442	8,995
Barite and witherite	9,576	1,412
Cement	6,495	12,775
Chalk	18	229
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Bentonite	2,636	3,158
Fire clay	831	----
Fuller's earth	262	18
Kaolin	280	168
Other	----	363
Products:		
Refractory (including nonclay brick and cement)	19,704	19,531
Nonrefractory	246	224
Diamond, industrial—carats	6,020	675
Diatomite and other infusorial earths	456	258
Feldspar	----	32
Fertilizer materials, crude and manufactured:		
Nitrogenous	19,638	15,832
Phosphatic	180,010	170,472
Potassic	49,141	36,440
Other, including mixed	6	(2)
Fluorspar	1,053	2,218
Graphite, natural	100	318
Lithium minerals	83	----
Magnesite	4,872	2,727
Mica, all forms	40	24
Pigments, mineral, including processed iron oxides	248	140
Sodium and potassium compounds, n.e.s.:		
Caustic soda	9,995	11,896
Caustic potash, sodic and potassic peroxides	204	124
Stone, sand and gravel:		
Dimension stone	200	41
Dolomite	25,813	85,350
Other	866	41
Sulfur:		
Elemental, all forms	56,403	32,612
Sulfuric acid	8	19
Talc, steatite, soapstone, pyrophyllite	174	213
Other nonmetals:		
Oxides and hydroxides of magnesium, strontium, and barium	102	97

See footnotes at end of table.

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Table 4.—Chile: Imports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Commodity	1966	1967
NONMETALS—Continued			MINERAL FUELS AND RELATED MATERIALS —Continued		
Other nonmetals—Continued					
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.—value	$31,094	$17,317	Petroleum:		
Mineral insulating materials, crude or processed—value	$390,953	$153,930	Crude	2,292,645	2,141,544
Other, n.e.s.—do	$222,820	$58,263	Refinery products:		
MINERAL FUELS AND RELATED MATERIALS			Gasoline		
Asphalt and bitumen, natural	5,764	296	42-gallon barrels	109,386	189,118
Carbon black and gas carbon	3,960	2,030	Kerosine and jet fuel		
Coal, all grades, including briquets	80,949	288,577	42-gallon barrels	537,770	418,293
Coke and semicoke	269	136	Distillate fuel oil	113,680	124,786
Hydrogen, helium, rare gases	118	60	Residual fuel oil	69,190	320,635
Natural gas liquids	--	36,075	Lubricants	12,417	39,120
Peat, including peat briquets and litter	--	6	Mineral jelly and wax	9,946	11,802
			Other	9,264	2,706
			Mineral tar and crude chemicals from coal, petroleum and natural gas	3,313	182

[1] Items included in some commodity entries reported herein differ from those included previously 1966 data have been adjusted or corrected to conform to these modifications.
[2] Less than ½ unit.

Source: Camara de Comercio de Santiago de Chile. Comercio Exterior, Chile, 1966 and 1967.

COMMODITY REVIEW

METALS

Copper.—Power and water shortages seriously affected the productivity of the second largest copper producer and probably lessened potential increases in output of many other producers. However, the performance of most medium and small producers improved notably, partly in response to the high prices paid for copper and partly because of other incentives such as loans and technical assistance offered by Empresa Nacional de Mineria (ENAMI), the Government-owned copper producing enterprise. Also notable was the satisfactory progress of expansion programs being undertaken throughout most of the industry. Some important projects were completed during the year and at least one large project appeared to be about 1 year ahead of scheduled completion.

At the El Teniente mine of Sociedad Minera El Teniente, S.A., southeast of Santiago, ore was mined and processed at capacity levels from January to May, after which production fell off because of the drought-caused decrease in the supply of water for ore processing and power generation. The company managed to minimize the power problem during the latter part of the year by importing 19 diesel-electric generating units. Some production problems also were encountered in the treatment of refractory concentrates at the smelter. As a net result of these several problems, total copper production was approximately 15 percent less than the record output attained in 1967.

The company mined and milled a little more than 11.5 million metric tons of ore during the year and produced 97,445 metric tons of copper in blister form as well as 56,673 tons in fire-refined form.[2] Roughly half the blister not further refined by the company was sent to the Government-owned Las Ventanas smelter-refinery complex to be electrolytically refined on a toll basis.

The $230 million capital expenditure program being undertaken by the company to expand nominal production capacity[3] from 180,000 tons to 280,000 tons of copper annually was ahead of schedule. Barring major setbacks, it appeared the

[2] Quantities of copper given here and elsewhere in this review represent fine copper content of the product indicated.
[3] In this review data representing production capacities or estimated future production are given as reported and usually represent short rather than metric tons.

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program might be completed in 1970 instead of 1971 as originally estimated. Completion of the new two-lane highway which will replace the old narrow-gage railway between Rancagua and Sewell was expected by mid-1969.

The two major Chilean subsidiaries of The Anaconda Company, Chile Exploration Co. at Chuquicamata and Andes Copper Mining Co. at El Salvador and Potrerillos, managed slight increases in copper production, but output of the relatively small La Africana mine operated by another subsidiary, Santiago Mining Co., was about 20 percent less than that of 1967. Chile Exploration Co. treated approximately 18.5 million tons of sulfide ore and 8.24 million tons of oxide ore and produced 116,201 metric tons of copper in blister form in addition to 163,265 tons in electrolytic forms. Andes Copper Mining Co. milled about 8.63 million tons of El Salvador ore and recovered 17,320 tons of copper in blister form as well as 68,945 tons in electrolytic forms. Concentrates produced at La Africana contained about 4,360 tons of copper.

Expansion programs of Anaconda subsidiaries reportedly were progressing on schedule. The new 180,000-ton-per-year electrolytic refinery unit at the Chuquicamata ore processing complex was dedicated in December. Other projects underway at the complex included two additional concentrator units, additional reverberatory and convertor furnaces, a shaft furnace, and a sulfuric acid plant. Additional generating units were being installed at the Tocopilla powerplant to assure an adequate supply of electric power for the expanding company facilities. Improvement and expansion of the El Salvador mine and concentrating facilities continued, with completion scheduled for 1970.

Another Anaconda venture, in which the Government of Chile holds a 25-percent interest, is the development of the new Exótica open pit mine near Chuquicamata by Cía. Minera Exótica, S.A. By yearend approximately half of 100 million tons of overburden had been stripped away, and construction of the crushing plant and an ore conveying system was on schedule. It was estimated that by mid-1970 the mine would begin delivering ore to the Chuquicamata plant for toll treatment. According to the planned mining rate, the Exótica mine should yield about 112,500 tons of copper annually.

Virtually all elements of the medium and small sectors of the copper industry increased in productivity during 1968. ENAMI increased output of copper in blister form at its Paipote smelter from 20,893 tons in 1967 to 22,171 tons in 1968 and at its Las Ventanas smelter from 34,895 tons to 38,219 tons. The refining unit at Las Ventanas produced 80,959 tons of copper in electrolytic form compared with 67,053 tons in 1967; however, part of this copper was refined from El Teniente blister. The Chagres smelter of Cía. Minera Disputada de Las Condes produced 20,707 tons of copper in blister form compared with 15,585 tons in 1967, and Empresa Minera Mantos Blancos, S.A., increased its production of copper in fire-refined form from 21,762 tons to 26,520 tons. All the above organizations were engaged in various projects designed to increase their overall production capacities. ENAMI projects already underway and others planned represent an eventual investment of about $85 million.

Several new large investment projects were in various stages of planning or development during 1968. The most advanced was the Río Blanco Project located about 37 miles northeast of Santiago which was estimated to be 41 percent completed by yearend. This project is being carried out by Cía. Minera Andina, S.A., in which Cerro Corp. holds a 70 percent equity interest and the Government's Corporacíon del Cobre (CODELCO) holds the remaining 30 percent. During the year the preconstruction cost estimate of $89 million was found to be grossly underestimated, and the budgeted cost of the project was raised to $157 million. The Río Blanco mine is scheduled to begin operating in 1971 and is expected to produce concentrates containing approximately 67,500 short tons of recoverable copper annually. About two thirds of the concentrates produced probably will be shipped to Japanese smelters, and most or all the remainder will be smelted at Las Ventanas.

Approval was granted by the Government for Cía. Anónima Cuprífera de Sagasca to proceed with a project to develop an open pit mine and a leaching plant at the Sagasca copper deposit east of Iquique. Continental Copper and Steel Industries, Inc., will hold a 75-percent interest and CODELCO the remaining 25 percent in this $32.5 million venture. The

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company envisages a 4,000-ton-per-day leaching operation and the recovery of about 26,000 tons of copper per year in precipitate form.

Cía. Minera International Telephone and Telegraph Geophysical, Inc., S.A., applied to the Government for authorization to invest up to $80 million in copper production in Chile. By May 1968 the company had spent $2 million on exploration activities attempting to find a suitable deposit to exploit. It was reported that deposits near Andacollo southeast of La Serena were among the more promising of those under consideration for development.[4]

Iron Ore.—A major development in the Chilean iron ore industry during 1968 was the liquidation of Cía. Minera Santa Fe in which the Philipp Brothers Division of Engelhard Minerals & Chemicals Corp. held the majority interest. Santa Fe was one of the largest iron ore producers in Chile and was the largest exporter by virtue of substantial purchases of additional ore from smaller producers. Cía. Minera Santa Bárbara, a privately owned Chilean firm, took over the Santa Fe mining operations and its export commitments about midyear. Details of the liquidation were not disclosed, and it was not clear if Santa Bárbara would in fact acquire all Santa Fe assets including Cía. Minera San Andrés, a jointly owned subsidiary of the two companies, and ownership of the large El Laco deposits and other undeveloped properties held by Santa Fe. It was reported that Santa Bárbara would utilize its modernized iron ore port facilities at Huasco and Chañaral for all export shipments of the combined mining operation. Available information indicated that total iron ore shipments by Santa Bárbara and Santa Fe during the year amounted to approximately 5,120,900 metric tons, including ore purchased from other producers.

In March 1968 the Chilean Government authorized Bethlehem-Chile Iron Mines Co. to invest $20 million to expand the annual production of the company's Romeral mine from an output level of about 2,700,000 metric tons to roughly 4,100,000 tons of iron ore and concentrate. Major features of the expansion program include purchase of additional equipment to increase capacity for ore extraction and waste removal, construction of a new concentrator plant, acquisition of additional rolling stock to increase railroad haulage capacity, and improvements at the port of Guayacán to permit docking and loading of 80,000-ton vessels. The new concentrator is scheduled to be completed and operating at full capacity by the end of 1971.

During 1968 Bethlehem-Chile produced 2,979,176 metric tons of beneficiated ore and removed more than 9.5 million tons of waste at the Romeral mine. The company also produced 304,214 metric tons of ore and concentrate and removed more than 1 million tons of waste at the nearly depleted Tofo mine. Output at both mines was substantially higher than that of 1967 when labor problems restricted production at Romeral to 2,329,220 tons and that at Tofo to 223,814 tons, although a part of the increase at Tofo must be attributed to expansion of the capacity of the beneficiation plant during the year.

Iron ore shipments by Bethlehem-Chile Iron Mines Co. for 1968 were reported as follows:

	Metric tons
Romeral Division:	
Furnace ore to United States	345,329
Furnace ore to Japan	1,670,647
Furnace ore to CAP steel mill	857,712
Local sales	113
Total	2,873,801
Tofo Division:	
Furnace ore to Japan	64,168
Fines to Japan	65,920
Local sales	151
Total	130,239

Source: Skilling's Mining Review. V. 58, No. 7, Feb. 15, 1969, p. 12.

Cía. de Acero del Pacífico, S.A. (CAP), produced 2,926,699 metric tons of ore at the Algarrobo mine during 1968 compared with 2,399,762 tons in 1967 and 3,236,870 tons in 1966. Whereas the below normal output for 1967 was mainly the result of a long strike by mine workers, the low level for 1968 was attributed to delays encountered in receiving and readying new equipment to cope with the increasing

[4] The Anaconda Company. 1968 Annual Report. Mar. 28, 1969, pp. 6, 8.
Cerro Corp. 1968 Annual Report. Mar. 14, 1969, pp. 7–8.
Kennecott Copper Corp. Annual Report, 1968. Feb. 20, 1969, pp. 11–12.
Sutulov, Alexander. Chile. Mining Annual Review, Mining Journal, (London). June 1969, pp. 257–259.
U.S. Embassy, Santiago, Chile. State Department Airgram A–144 and enclosure, May 7, 1969, 8 pp.

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ratio of waste to ore as mining progresses. The company hoped to attain an output level of about 3,350,000 metric tons early in 1969 and increase this to about 4,000,000 tons by mid-1970.

During the year CAP shipped a total of 2,712,342 metric tons of ore to Japanese (about 90 percent) and United States (about 10 percent) markets. Of the ore shipped, 2,271,950 tons was blast furnace ore, 414,686 tons was sinter fines, and 25,706 tons was lump ore. All of the latter was consigned to the United States. In February CAP decided to discontinue the production and sale of lump ore and to gear its production entirely to blast furnace grades and sinter fines.

The company hopes for a marked improvement in recovery of salable products when installation of a new ore beneficiation plant is completed at the mine about mid-1970. It is expected that this plant will permit recovery of about 700,000 tons of sinter fines annually from the minus ⅜-inch screen rejects from the crushing plant; approximately 7 million tons of such rejects reportedly has accumulated in stockpiles as of 1968. In another move to improve its competitive position in the iron ore market, CAP initiated works to expand its Guacolda port installations to accommodate 80,000-ton ore carriers and to increase its ore storage and loading capacities. CAP has estimated that expansion projects underway and planned at Algarrobo and Guacolda will require the expenditure of $1.3 million in foreign currency and the equivalent of $3.1 million in Chilean escudos.[5]

Iron and Steel.—Ingot steel production by Cía. de Acero del Pacífico, S.A. (CAP), whose steel mill at Huachipato near Concepción is the nation's only large producer, decreased nearly 12 percent from the record output level attained in 1967. The general effects of the drought and the continued economic slowdown during the first half of the year, as reflected in the sustained lag in general construction and delayed starting of a number of large investment projects, lessened the expected demand for finished steel and undoubtedly contributed to the lower level of raw steel output during 1968. However, labor disputes were directly responsible for actual production losses. The steel mill was shut down 4 days by two short strikes in January and March and nearly 4 weeks during May and June; the latter strike also resulted in a temporary curtailment of domestic sales of mill products. Plant operations were further hampered by a 2-week strike of electrical workers during March and April. The general power shortage caused by the drought did not seriously affect operations at the steel mill, partly because some power normally consumed by the local sugar industry became available to CAP. Also, the company transferred four, 300-kilowatt diesel generators from its Algarrobo mine to the steel mill, and purchased a 2,100-kilowatt diesel generator from the United States to supply additional power.

CAP reported production of iron and steel products by its Huachipato plant during 1968 as follows:

Products	Metric tons		
	Jan.–June	July–Dec.	Total
Pig iron	190,245	256,823	446,568
Steel ingots	218,152	307,996	526,148
Semifinished products	189,123	265,404	454,527
Finished rolled products	179,902	230,966	410,868
Pipe	2,377	4,823	7,200

CAP shipments of finished products to domestic and export markets for 1966–68 were as follows, in thousand metric tons:

	1966	1967	1968
Domestic	425.5	368.9	384.2
Export	12.6	68.0	21.1
Total	438.1	436.9	405.3

The previously announced expansion program to increase ingot steel capacity to 1 million tons by 1971 was revised because consumer demand has failed to attain projected levels and also because of the probability that the firm would be unable to generate sufficient funds in Chilean currency to meet the original schedule.

[5] Bank of London & South America Review. V. 2, No. 18, June 1968, p. 350.
Cia. de Acero del Pacifico, S.A. Annual Report, July 1, 1967, to June 30, 1968, 28 pp.
Skilling's Mining Review. El Algarrobo Mines of Chile. V. 57, No. 50, Dec. 14, 1968, pp. 4–8.
———. 1968 Company Iron Ore Shipments. V. 58, No. 27, July 5, 1969, p. 6.
U.S. Embassy, Santiago, Chile. State Department Airgrams: A–691 and enclosure, June 26, 1968, 5 pp.; A–826 and enclosure, Aug. 30, 1968, 36 pp.

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CAP officials therefore decided to proceed with expansion in two or more stages. The company hopes to increase ingot capacity to 800,000 tons per year by 1973 by proceeding with installation of a new oxygen converter steel shop as well as increasing its capacity for rolling bars. Loans were arranged at yearend 1967 through Austrian, French, and British institutions to provide the foreign exchange and part of the local currency required for the new steel shop. In the meantime, minor projects underway were to be completed and still others will be initiated on a flexible priority basis. For example, a new loading tower to speed unloading of bulk raw materials was under construction at the Huachipato port and construction was begun on a new port at San Vicente to accommodate handling of nonbulk materials.

In July 1968 an agreement was reached between Corporación de Fomento de la Producción (CORFO) and the major private stockholders of CAP permitting CORFO to increase its shareholdings through acquisition of enough privately held shares to increase the combined holdings by Government entities to 55 percent. The change in majority ownership from the private to the public sector was not expected to have a marked effect on the management's control of operations but could materially improve the company's ability to secure the funds necessary to implement its expansion program.[6]

NONMETALS

Fertilizer Materials.—Organization and control of the Chilean natural nitrate and iodine industry was completely restructured in midyear as a consequence of expiration on June 30 of legislation which had governed it since 1934. On July 1, the Government and the Anglo-Lautaro Nitrate Corp. formed a new mixed enterprise, Sociedad Química y Minera de Chile, S.A. (SOQUIMICH), to consolidate all nitrate and iodine operations. Anglo-Lautaro, which had been the largest producer by far, received a 62.5-percent interest in the new company. The remaining 37.5 percent was acquired by the Government's Corporación de Fomento de la Producción (CORFO) which had operated the only other major nitrate venture, Empresa Salitrera Victoria, S.A., since 1960.

The new company took control of the Chilean assets of Anglo-Lautaro, having an agreed-on value of $49.6 million, in exchange for which Anglo-Lautaro received SOQUIMICH shares with a nominal value of $25 million as well as 20-year debentures with a nominal value of $24.6 million guaranteed by CORFO. For its share in SOQUIMICH, CORFO agreed to contribute the assets of Empresa Salitrera de Victoria, valued at $8 million, to make payment of $2 million in cash over a period of 18 months, and to provide and service credits of $5 million over a 5-year period. CORFO directors on the board were given veto powers over certain policy matters, and CORFO also received the right to purchase a series of reserved shares and thus become the majority owner after a period of 5 years.

Reportedly, the new company was committed to invest $7 million in the production of ammonia and urea if requested to do so by the Government.

Much of the sales organization of the Chilean Nitrate and Iodine Sales Corporation (COVENSA), which ceased to exist on June 30, was taken over by SOQUIMICH which will market its own production.

In recent years the nitrate industry has declined progressively, partly because of higher production costs and labor problems, and partly because of loss of a sizable share of the market to producers of synthetic nitrates. This trend continued in 1968 as total production decreased 22 percent compared with 1967 output and was 36 percent lower than 1966 output. One factor that contributed to the decline in overall production during 1968 was the programed reduction in output of sodium nitrate by Anglo-Lautaro to permit increased output of more valuable potassium nitrate and thereby increase the average unit value of the nitrates recovered. Any benefits that might have accrued from this program of operation were obscured by a 7-week strike of about 4,000 workers during September and October, which resulted in production losses estimated at 80,000 metric tons and forced a temporary suspension of domestic sales of potassium nitrate. Instead of a planned increase, the

[6] Banco Central de Chile. Boletin Mensual, No. 494. April 1969, p. 512.
U.S. Embassy, Santiago, Chile. State Department Airgram A-0001 and exclosures I-IX, Jan. 1, 1969, 21 pp.
Second work cited in Footnote 5.

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total output of potassium nitrate was only about half that of the previous year.

Despite setbacks suffered during 1968, SOQUIMICH hoped to make its operations profitable by concentrating on the recovery of more potassium nitrate as well as other salable byproducts such as iodine, boric acid, and sodium sulfate. The company also planned to investigate the possibility of recovering lithium, magnesium, and other components occurring in the nitrate caliche. Other prospects for reviving the industry were seen in the promotion of industrial uses of natural nitrates, such as their use in the manufacture of sodium and ammonium nitrate-fuel oil explosives, and in further exploitation of the domestic market, which reportedly absorbs about one-third the total nitrate output and appears to be growing steadily at a rate of about 12 percent annually.[7]

Chilean nitrate exports for 1968 were as follows:

Destination	Metric tons
United States	196,250
Brazil	33,558
Mexico	20,533
Spain	19,790
France	16,500
Japan	11,274
Argentina	8,648
Others	117,513
Total	424,066

Source: U.S. Embassy, Santiago, Chile. State Department Airgram A-81, Mar. 18, 1969, 1 p.

Salt.—An eightfold increase in production of Chilean salt since 1965 is attributable primarily to the recent development of a large scale, mechanized mining operation about 40 kilometers south of Iquique by Cía. Minera Santa Adriana, S.A. The original company was organized by Osvaldo and Alfonso F. de Castro to exploit salt concessions they had acquired in the northern part of Salar Grande. In 1967 Marcona Corp. of San Francisco purchased a 65.5-percent interest in the venture, increasing its interest to 73.2 percent in 1968. During 1967 the reorganized company began to develop a multiple-bench, open pit mine at the old minesite known as Salina Bahia Blanco. By the latter part of the year a grinding and screening plant with an annual capacity of 1,800,000 tons and ship-loading facilities had been constructed at a site on Patillos Bay about 29 kilometers by road northwest of the mine.

The top 4 feet of the salt deposit at Bahia Blanco contains considerable clay and is stripped and wasted. Clay also contaminates the salt to an additional depth of 36 feet, and this section is mined in two 18-foot benches for road salt. A little clay has penetrated still deeper and a third bench 26 feet high is mined selectively for either road or chemical-industrial salt. White, high-grade chemical-industrial salt is mined from two deeper 26-foot benches, making the total depth of the pit 118 feet. Typical analyses of the two types of salt produced indicate a sodium chloride content of 98.8 percent for road salt and 99.37 percent for the chemical-industrial grade. The mined salt is trucked to Patillos for crushing and screening and then loaded by conveyor into dry bulk carriers owned and operated by San Juan Carriers, Ltd., a wholly owned Marcona subsidiary.

Santa Adriana reported production of 358,328 metric tons of salt during 1967 and claimed salt sales of 33,980 tons within Chile, 197,902 tons to Japan, and 92,020 tons to the United States. Shipments reported by the company during 1968 totaled 743,063 metric tons, of which 681,607 tons was exported to Japan and the United States and the remainder sold to Chilean consumers.

Shipments of high-quality salt to Japan have been made under a 3-year contract with Mitsui & Co., Ltd., to supply major Japanese chlorine and caustic soda producers. The smaller quantities shipped to the United States have consisted of road salt destined for consumers along the Eastern coast. A principal U.S. consumer has been Diamond Crystal Salt Co., which entered into a long-term agreement to market Chilean salt in the United States and reportedly was considering possible equity participation in Cía. Minera Santa Adriana. Santa Adriana expected its total shipments in 1969 to exceed 1,000,000 tons.[8]

[7] U.S. Embassy, Santiago, Chile. State Department Airgrams A-826, Aug. 30, 1968, 36 pp., and A-934 (unclassified paragraph), Oct. 19, 1968, p. 5.

———. State Department Telegram 3617 (unclassified paragraphs), May 13, 1968, 2 pp.

[8] Bleimeister, William C. Mining the Salar Grande. Paper prepared for Marcona Corp. and presented at Third Symposium on Salt, Cleveland, Ohio, Apr. 24, 1969, 17 pp.

Cyprus Mines Corp. Annual Report, 1968. Mar. 12, 1969, p. 10.

Diamond Crystal Salt Co. 1969 Annual Report, fiscal year ending Mar. 31, 1969, p. 5.

Skilling's Mining Review. V. 58, No. 5, Feb. 1, 1969, p. 12.

U.S. Embassy, Santiago, Chile. State Department Airgram A-826, Aug. 30, 1968, 36 pp.

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Sulfur.—The Chilean Government is attempting to promote an increase in sulfur production, particularly from the extensive volcanic deposits located in the high Andean areas. The responsibility for this effort was assigned to the Comité para la Producción del Azufre of CORFO, and a factsheet was issued in 1967 giving pertinent information on known Chilean deposits as well as notations concerning the physical conditions attendant to their exploitation.[9]

It was reported that two of the principal native sulfur producers, Sociedad Azufrera Aucanquilcha and Sociedad Azufrera Borlando, were expanding their productive capacities in 1968 and that two overseas groups were negotiating with CORFO with regard to possible development of deposits at Purico Volcano east of San Pedro de Atacama. Texas Gulf Sulphur Co. carried out investigations of the Plato de Sopa deposit near the Argentine border east of Taltal and of other deposits in northern Chile, but the results of these studies were not announced. M. W. Kellogg Co. was engaged by Marcona Corp. to study the feasibility of establishing a facility near Patillos to produce sulfuric acid and cement clinker from natural anhydrite that is readily available in the area.[10]

Expansion underway at the ENAMI Paipote and Las Ventanas smelters includes plants to produce sulfuric acid from converter gases. Annual capacity of the plant at Paipote will be about 40,000 metric tons of acid while capacity of the plant at Las Ventanas will be about 60,000 tons. Part of the output of the latter unit should be available for use by the chemical and other industries in central Chile.[11]

MINERAL FUELS

Coal.—The severe drought during 1968 seriously curtailed generation of hydroelectric power, and Chile was hard-pressed to provide the additional coal needed by thermal-electric plants to generate extra power to partly offset the overall shortage. Much of the electric power consumed in the populous central Provinces of Santiago, Valparaíso, and Aconcagua is supplied by three coal-fired plants operated by Cía. Chilena de Electricidad, Ltda. (CHILECTRA), which consumed 290,044 tons of coal in 1967. By midyear 1968, CHILECTRA plants were operating at full capacity, and coal consumption was double the normal rate. As the available coal supply dwindled, the company reportedly was considering partial conversion to use of imported fuel oil by yearend if necessary.

Part of the coal problem was attributed to legislation passed early in 1967 which decreed the miners' workday should start upon arrival at the portal rather than at the working face, thereby cutting effective production per man-day. Although the major producer, Carbonifera Lota-Schwager, S.A., attempted to compensate for the shorter effective workday by increasing its underground work force by 800 by the end of 1967, preliminary data indicate domestic output increased only 84,000 tons in 1968, and the total was considerably lower than 1960–66 levels. Of the increase, only about 48,000 tons was available for noncaptive consumption and stocks, which had been drawn down from 348,000 tons at yearend 1966 to 177,000 tons at yearend 1967, were virtually depleted by the latter part of 1968. As a result, AID authorized Chile to import 250,000 tons of U.S. coal under program fund financing to cover extraordinary coal demand for the period December 1968 to May 1969. This import quota was to be in addition to approximately 200,000 tons imported annually for coking purposes and was not intended to replace or restrict local coal output.

A production goal of 1.7 million tons was set for 1969, and Lota-Schwager began hiring 700 additional workers in order to raise its output. The planned increase in production was partly predicated on the scheduled completion in late 1969 of the 125,000-kilowatt Bocamina thermal-electric plant that Empresa Nacional de Electricidad, S.A., is constructing at Coronel. This plant will be fueled by coal from the nearby Lota-Schwager mines.[12]

Natural Gas.—Empresa Nacional del Petróleo (ENAP), the State-owned petroleum enterprise which exercises a monopoly

[9] U.S. Embassy, Santiago, Chile. State Department Airgram A–257 and enclosure, Nov. 24, 1967, 6 pp.

[10] Sulphur (London). No. 75, March/April 1968, p. 8; No. 79, November/December 1968, pp. 22–23.

[11] Sutulov, Alexander. Chile's Small Copper Mines Expand. Wor'd Mining, v. 5, No. 4, April 1969, pp. 50–51, and 54–55.

[12] U.S. Embassy, Santiago, Chile. State Department Airgrams: A–744, July 22, 1968, 3 pp.; A–826, Aug. 1968, 36 pp.; A–988, Nov. 27, 1968, 2 pp.; and A–1010 (unclassified paragraph), Dec. 18, 1968, 4 pp.

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on petroleum and natural gas exploration, production, and processing, reported gross withdrawal of 246,784 million cubic feet[13] of natural gas during 1968, slightly less than total 1967 production. Output continued to be divided almost equally between fields located on the mainland and those on the island of Tierra del Fuego in southern Magallanes Province. About 72 percent of the gas withdrawn was reinjected for repressuring and storage, compared with 76 percent reinjected in 1967. Three major fields again contributed about 53 percent of total production. Posesión (mainland) remained the largest gas producer, yielding 29.5 percent of the total, followed by Cullen (Tierra del Fuego) with 13.7 percent, and Daniel (mainland) with 9.3 percent. Gas reinjection at these fields corresponded to approximately 93 percent of gross withdrawal at Posesión, 96 percent at Cullen, and 69 percent at Daniel.

The volume of gas treated at ENAP gas-processing plants at Manantiales (Tierra del Fuego), Cullen, and Posesión decreased more than 3 percent to the lowest level since 1963, resulting in a proportionately lower recovery of natural gas liquids. Exports of liquefied propane and butane, all to Argentina, also dropped to the lowest level in 5 years, amounting to only 280,000 barrels compared with exports of 443,000 barrels in 1967. However, sales of natural gas to the electric powerplant and to minor consumers in Punta Arenas were 70 percent greater than in 1967, which was the first full year in which piped gas was marketed in the area.

ENAP completed preliminary studies for a $14 million expansion project to augment its gas-processing facilities in Magallanes, and commissioned the Fluor Corp. of Los Angeles to provide the necessary design and engineering services. The project will involve construction of two new facilities. A plant capable of processing 300 million cubic feet of natural gas daily will be built at Posesión for the extraction of liquefied propane, butane, pentane, and other heavier hydrocarbons, perhaps even ethane. At Cabo Negro, about 25 kilometers north of Punta Arenas and some 200 kilometers from Posesión, another plant will be constructed to separate various fractions of the liquefied gas mixture produced at Posesión. The Cabo Negro installations will also include port facilities and refrigerated storage tanks. It is anticipated that the two-part complex will be operational by the end of 1970.[14]

Petroleum.—During 1968, ENAP expended most of its exploratory efforts in Magallanes, Arauco, and Santiago Provinces. In Magallanes, three seismic crews completed 650 kilometers of reflectivity profiles, and geologists conducted reconnaissance studies in the Precordillera zone of Brunswick Peninsula and Tierra del Fuego and Navarino Islands. Geologic studies were also carried out in the coastal area of Santiago Province in the vicinity of Navidad and the mouth of Río Rapel. The tempo of drilling activity increased sharply with completion of 100 wells totalling 187,410 meters compared with 68 wells totalling 142,590 meters in 1967. The overall success ratio was 53 percent; however, most of the completions were development wells. Drilling completed during 1967 and 1968 is shown in the following tabulation:

Type of well	Number of completions			
	Petroleum	Gas	Dry	Total
1967:				
Exploration	----	----	10	10
Extension	3	3	13	19
Development	24	4	11	39
Total	27	7	34	68
1968:				
Exploration	1	1	15	17
Extension	1	1	12	14
Development	35	14	20	69
Total	37	16	47	100

One new petroleum discovery was made in Magallanes and a gas discovery in Arauco Provinces. The discovery hole near Lebu in Arauco encountered dry gas (virtually all methane) at 1,500 meters; however, another wildcat at Lebu, one eastward near Pehuén, and two more northeast near Curanilahue all were abandoned as dry. Nevertheless, the verified presence of gas in the formations raised hopes of finding commercial accumulations of hydrocarbons in this part of Chile, and more exploration

[13] Converted from cubic meters using a factor of 35.3145 cubic feet per cubic meter.
[14] Empresa Nacional del Petroleo, Chile. Boletin Estadistico, Seccion Tecnica, 4° Trimestre y Anual. V. 42, 1968, 58 pp.
———. Memoria Anual, 1968, 16 pp.

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was planned during 1969, including the deployment of one of the seismic crews from Magallanes.

Production of crude petroleum by ENAP recovered remarkably in 1968 with an increase of 10.7 percent after 3 consecutive years during which output declined. Daily production averaged 37,418 barrels and total output for the year amounted to a record of 13,695,400 barrels, about 9,000 barrels more than the previous record set in 1964. Increased production was attributed mainly to extension of the Cañadón field on the mainland and of the Catalina Sur field on Tierra del Fuego. Production at Cañadón increased 139 percent to nearly 1.5 million barrels as this field became the second largest mainland producer. At Catalina Sur, new wells helped increase production 82 percent to approximately 1.17 million barrels. The 1968 production record was also bolstered by a notable increase in output at the large Calafate field on Tierra del Fuego which helped to offset production losses at many fields, particularly at the other major mainland fields. Overall, the share of total production contributed by fields on Tierra del Fuego increased slightly to 52.2 percent. A comparative table of production by field for 1967 and 1968 follows:

Location and field	Thousand 42-gallon barrels	
	1967	1968
Mainland:		
Daniel	1,952	1,707
Daniel Este	1,542	1,469
Cañadón	627	1,498
Posesión	1,292	1,216
Others	619	615
Total	6,032	6,505
Tierra del Fuego:		
Cullen	1,722	1,682
Calafate	1,239	1,539
Catalina Sur	644	1,174
Tres Lagos	639	743
Others	2,093	2,052
Total	6,337	7,190
Grand total	12,369	13,695

In accordance with an agreement concluded with Yacimientos Petroliferos Fiscales of Argentina in 1966, ENAP transported approximately 1.9 million barrels of crude from Argentina's Condor and Cerro Redondo fields through ENAP facilities to its Gregorio terminal. For its services, ENAP collected about 281,000 barrels on a toll basis and also purchased about 157,000 barrels in addition for refining in Chile.

The major part of the country's liquid fuel needs continued to be satisfied by output of the Concón refinery near Valparaíso and the Concepción refinery near Concepción. During 1968, 14,951,700 barrels of crude were processed at Concón, 11,484,560 barrels at Concepción, and 502,430 barrels at the small topping unit at Manantiales. The total volume of crude processed was nearly 8 percent more than in 1967, and Chilean crude provided about two-thirds of the 1968 total compared with slightly less than half that processed in 1967. The net production for sale of the two large refineries for 1968 was as follows:

Product	Net production (thousand 42-gallon barrels)	
	Concón	Concepción
Aviation gasoline	226	------
Other gasoline and naphtha	4,294	4,858
Kerosine	1,146	1,311
Distillate fuel oil	2,174	2,408
Residual fuel oil	5,870	2,135
Liquefied petroleum gas	495	1,190
Other, including solvents	276	------
Total	13,981	11,402

Ground was broken for the installation of a new atmospheric distillation unit at the Concepción refinery by The Lummus Co. This unit is designed for a crude petroleum capacity of about 27,000 barrels per day and will increase total refinery crude capacity to about 63,000 barrels per day when the unit goes on stream in 1970.

Storage facilities were completed at the Linares and San Fernando pumping and distribution stations along the Concepción-Maipú (Santiago) pipeline, and automatic liquefied gas bottling equipment at both stations was expected to be operational by mid-1969. A liquefied gas receiving and storage terminal at Antofagasta also was completed in 1968; installation of automatic bottling equipment was planned in 1969.[15]

Petrochemicals.—Several petrochemical facilities were under construction in the Concepción area during 1968. All were scheduled for completion during 1970. The French subsidiary of The Lummus Co. was

[15] Work cited in footnote 14.

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building a $14 million ethylene plant for ENAP at the Concepción refinery. This unit is designed to produce 60,000 tons of ethylene annually as well as substantial quantities of liquefied petroleum gas.

An $8 million chlorine and caustic soda plant was being constructed by Lurgi Geselschaffen for Petrochímica Chilena, S.A., a Government-owned enterprise formed in 1967 by ENAP and CORFO. Annual output of the plant is expected to be about 33,000 metric tons of chlorine and 37,000 tons of caustic soda.

Petrochímica Dow, S.A. (PETRODOW), jointly owned by The Dow Chemical Co. (70 percent) and Petrochímica Chilena (30 percent), began work on a $30.5 million, three-plant complex designed to produce 18,200 tons of vinyl chloride, 15,000 tons of polyvinyl chloride, and 20,000 tons of low-density polyethylene annually.

A proposal to establish a large plant near Punta Arenas to utilize natural gas as raw material to produce ammonia, urea, and other fertilizer products, mainly for export, was still under consideration, but no definitive action was taken to implement such a project.[16]

[16] Work cited in footnote 14.

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The Mineral Industry of Mainland China

By K. P. Wang [1]

Mainland China continued to be an important mineral producer by world standards, but mineral output value (mine output plus value added derived from smelting and processing) still had not returned to the $4 to $4.5 billion level estimated for 1966. Economic conditions in 1968 [2] did show considerable improvement over those in 1967 when the politically inspired Cultural Revolution seriously disrupted production. During the first half of 1968, national efforts were still being directed towards ending violence and disorder, but by the second half, most of the large mines and plants were again operating at pre-Cultural Revolution levels. Meanwhile, capital construction and mine development programs were far behind schedule.

A significant development in 1968 that directly influenced mineral output was the Chinese People's Liberation Army's (PLA) role in maintaining order. The PLA was given unprecedented access to management of the economy, and dominated many of the Revolutionary Committees and Great Revolutionary Alliances which were created to stimulate production. In contrast, the Cultural Revolution Committee lost considerable ground, with only five of its original 17 members still in power by February. While overall conditions had greatly improved, political turmoil had not been totally eliminated. At the steel center of Wuhan in central China, for example, fighting was reported as late as July 1968.

The raw material supply and products delivery systems were brought under control by late 1968. The railways had been in turmoil since the early days of the Cultural Revolution when Red Guard students coming from various parts of the country overloaded the normal traffic. Their subsequent involvement in policy and management matters of railways and industry made for further confusion. A series of three national railway conferences covering November 1967 to May 1968 and direct intervention by the Premier finally settled the many factional disputes and fighting that had flared up. In order to bring production back to normal, Mao extolled workers and told the students to go home during a speech in August at the famous steel center of Anshan. An effort to control scientists and technicians through the Party, however, resulted in lower morale and a slowdown in research and development. In agriculture, 1968 was another bumper crop year, even though fertilizers were in short supply. Imports and exports both declined, despite improvements in the economy late in the year.

Production at the Taching oilfield in Manchuria—the country's leading oilfield and model industrial city—reached a record high, following resolution of political disputes. Past production also may have been greater than what was credited by most foreign observers. There was no further information on the Shengli oilfield in Shantung, but another potentially important oilfield was reported—Shashih in Hupeh.

By late 1968, the Chinese Communists claimed that many of the large coal mines had topped their monthly output targets and were doing better than in earlier periods of the year.

Steel operations at the Anshan works returned to normal, with an alltime high output claimed at yearend. The Wuhan works probably was idle for most of 1968,

[1] Supervisory physical scientist, Division of International Activities.

[2] Far Eastern Economic Review 1969 Yearbook (Hong Kong). 1969, pp. 135–155.

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while output at the Paotou works increased considerably. A modern heavy media plant was installed at the Lungyen iron mine in Hopeh. Output of domestic fertilizer industry remained grossly inadequate. As construction projects began again at yearend, many cement plants resumed full-scale operations. The Cultural Revolution even hit mineral industries like asbestos and fluorspar, creating temporary shortages. Basic geological surveys were carried out, with significant discoveries reported for even remote Tsinghai. On December 27, 1968, mainland China exploded a second hydrogen bomb in its seventh nuclear test.

PRODUCTION

The Peking official organ—Jen-min Jih-pao (People's Daily)—practically ignored the state of the economy in its 1969 New Year's editorial. For a second consecutive year the Chinese Communists made no nationwide claims for major production items, except for oil and salt. Although overall production was considerably higher than in the disastrous year of 1967, the Chinese would rather make output comparisons with the output of the good year of 1966. There was still hardly any mention of the Third 5-Year Plan, supposed to have started in 1966.

High outputs were recorded for oil, coal, and salt, three commodities little affected by the political turmoil. Cement production was still below demand, as was that of many types of steels. Nonferrous base metals were still extracted in relatively small quantities, with none of the supposedly important discoveries brought into production as yet. Output of export metals like tin, tungsten, antimony, bismuth, and mercury changed little; apparently, large quantities were being stockpiled because of difficulty of selling in world markets.

Coal and steel each accounted for about one-third of the country's 1968 mineral output value; petroleum, nonferrous metals, and cement together made up a little more than one-fourth. At yearend 1968, serious efforts were being made to increase mineral production.

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Table 1.—Mainland China: Production of mineral commodities [e]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite [1]	400,000	400,000	400,000	350,000	380,000
Alumina	200,000	200,000	200,000	175,000	190,000
Metal, refined	100,000	100,000	100,000	80,000	90,000
Antimony, mine	15,000	15,000	15,000	12,000	12,000
Bismuth, mine	300	300	300	250	250
Copper:					
Mine	90,000	90,000	90,000	80,000	90,000
Metal, refined	100,000	100,000	100,000	90,000	100,000
Gold, troy ounces	60,000	60,000	60,000	50,000	50,000
Iron and steel:					
Iron ore [2], thousand tons	37,000	39,000	40,000	28,000	38,000
Pig iron, do	18,000	19,000	20,000	14,000	19,000
Steel ingot, do	14,000	15,000	16,000	11,000	15,000
Rolled steel, do	11,000	12,000	13,000	9,000	12,000
Lead:					
Mine	100,000	100,000	100,000	90,000	100,000
Metal, refined	100,000	100,000	100,000	90,000	100,000
Magnesium	1,000	1,000	1,000	1,000	1,000
Manganese ore, thousand tons	1,000	1,000	1,000	700	900
Mercury, 76-pound flasks	26,000	26,000	26,000	20,000	20,000
Molybdenum, mine	1,500	1,500	1,500	1,500	1,500
Silver, troy ounces	800,000	800,000	800,000	600,000	700,000
Tin, refined, long tons	25,000	25,000	22,000	20,000	20,000
Tungsten concentrate, about 68 percent WO_3	18,000	15,000	15,000	15,000	15,000
Zinc:					
Mine	100,000	100,000	100,000	90,000	100,000
Metal, refined	90,000	90,000	90,000	80,000	90,000
NONMETALS					
Asbestos	120,000	130,000	140,000	150,000	150,000
Barite	100,000	100,000	110,000	100,000	120,000
Cement, thousand tons	10,500	11,000	11,000	8,000	9,000
Fluorspar	200,000	220,000	250,000	250,000	250,000
Graphite	40,000	40,000	40,000	30,000	30,000
Gypsum	600,000	600,000	600,000	500,000	500,000
Magnesite, thousand tons	1,000	1,000	1,000	800	900
Phosphate rock, do	800	900	1,000	1,000	1,000
Pyrite, do	1,300	1,500	1,500	1,500	1,500
Salt, do	10,000	13,000	13,000	13,000	15,000
Sulfur	250,000	250,000	250,000	250,000	250,000
Talc	150,000	150,000	150,000	150,000	150,000
MINERAL FUELS					
Coal, thousand tons	290,000	300,000	325,000	225,000	300,000
Coke, do	15,000	16,000	17,000	13,000	15,000
Petroleum:					
Crude, do	8,500	10,000	13,000	11,000	15,000
Refinery products, do	8,000	9,000	12,500	10,000	14,000

[e] Estimate.
[1] Mostly diasporic bauxite. Data shown include only the bauxite for aluminum manufacture; in addition 100,000 to 200,000 tons was produced each year for making refractories.
[2] Converted to equivalent 50 percent Fe ore.

TRADE

Overall trade volume of mainland China, never much of a trading country, continued to decline, to possibly only $3.5 billion in 1968. The bulk of the year's trade was with free world countries; trade with communist countries, primarily East Europe and the Soviet Union, apparently was below 10 percent of the total. Both minerals and metals remained significant in total trade. Much of mainland China's mineral-related trade with the outside world involved export of traditional commodities—nonferrous metals, coal, cement, salt, and various other nonmetallics, and import of large quantities of fertilizers, sizable tonnages of steel products, and some new plant, industrial, and mining equipment.

For lack of published trade figures on mainland China, mineral trade data on other countries were used to detect trends. Although the Soviet Union was no longer the principal purchaser of Chinese export minerals and metals and supplier of petroleum products, Soviet imports of tin and tungsten, for example, were so great in the late 1950's and early 1960's that the tonnages reflected Chinese output. Main-

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land China now trades with many other countries in small individual transactions.

Japan has reemerged as mainland China's leading trading partner, primarily sending fertilizers and steel products to China in return for raw ores and metals. During 1968, Chinese fertilizer purchase contracts totaled 5.5 to 6.5 million metric tons, of which possibly 2.7 million valued at perhaps $38 to $40 per ton were with Japan. Japanese shipments of steel products to mainland China in 1968 totaled just over 1 million tons valued at roughly $136 million—sheets, plates, tubes and pipes were the principal items. Some of the more important Japanese mineral imports from China in 1968 were as follows, in metric tons: Antimony ore, 1,290; manganese ore, 30,771; tin, 496; mercury, 13.6; fluorspar, 111,240; salt, 719,058; and steatite and talc, 57,223. During the last 5 years, other lesser Japanese imports from China included iron ore, pig iron, coking coal, anthracite, alumina shale, and barite.

Western Europe supplied the rest of the Chinese fertilizer imports, mainly through a consortium called NITREX. West Germany ranked second to Japan in supplying steel products and was one of the larger importers of China's export metals. Various Western European countries furnished scrap iron and copper products to China, while some copper came from Chile. Gold and platinum were purchased by the Chinese in the London market. Sizable phosphate rock tonnages came from North Africa. It has been difficult to account for all the tin and tungsten coming out of mainland China, although tonnages have been much below estimated production; this suggests stockpiling by the Chinese.

During recent years, an Imperial Smelting Process (ISP), nonferrous smelter was contracted from the United Kingdom; basic-oxygen furnace (BOF) units were ordered from Austria; copper and iron mining equipment came from Sweden; fertilizer plants were purchased from the United Kingdom, Italy, and Japan; a West German Lurgi gas plant was being built; a large rolling mill from a European consortium was being negotiated; and petrochemical plants were ordered from Europe. While difficult to confirm, it can be surmised that the ISP plant was still in the planning stage, the BOF's and Lurgi plant were probably completed, the rolling mill was temporarily shelved, and only some parts of the petrochemical plants were installed. The Cultural Revolution probably had much to do with various shelved contracts and programs and absence of significant new purchases of mineral-related plants and equipment.

COMMODITY REVIEW

METALS

Aluminum.—The Fushun plant in Manchuria, rated at perhaps 80,000 to 100,000 tons of metal yearly, has been the key to Chinese aluminum production. In recent years, the Chinese were seeking European and Japanese help in expanding aluminum facilities, apparently to no avail as yet. Aluminum wire in the place of copper wire for generators was trial-tested at a Hanchow plant.

Antimony.—China retained its position as the world's leading antimony producer. National production showed little change from that of the previous year, and main sources were still Hsikwangshan in Hunan Province with secondary sources in Kwangsi Province. At the last Canton Fair in the fall of 1968, Hibino Metal Industries booked 1,800 tons of Chinese antimony ore (about 60 percent antimony grade) at around $7 per unit for Japan. Europe, as well as Japan, was anxiously awaiting Chinese offers of antimony in the forthcoming Spring 1969 Canton Fair.

Bismuth.—Mainland China has long been an important bismuth producer, usually contributing 5 to 10 percent of the world total. As in previous years, the bulk of the bismuth, found in association with tungsten and nonferrous metals, was exported.

Copper.—The country continued to experience an acute shortage of copper. For example, at yearend 1968 the Chinese were interested in buying 7,000 tons of Japanese copper, and in 1 week in early 1969, they bought 2,000 tons in Western Europe through the London Metal Exchange. This shortage had prompted the

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country to utilize more aluminum for electrical use and to make special exploration efforts for copper. Several sizable porphyry copper deposits reportedly had been found in North China. Various attempts to purchase Japanese copper smelters, in order to exploit sizable reserves already delineated, have so far not been successful. The relatively small Shenyang nonferrous smelter in Manchuria, mainly a refiner of copper, has had political difficulties.

Iron and Steel.—Iron and steel output was said to be above the 1967 level but not quite as high as in 1966. The Revolutionary Committees and Alliances, made up of PLA, labor and technocrat representatives, and Red Guards, had restored peace and order at most centers. By late 1968, high output claims, including monthly records, appeared. In fact, Chinese steel output in the second half of 1968 appeared to have been greater than in the corresponding period in 1966, thus indicating a very good year in 1969.

The Cultural Revolution had brought mainland China's program to obtain foreign steel plants and know-how to fill the technical void created by the Sino-Soviet rift to a virtual halt, because there was neither money and exports to pay for them nor the time to accommodate foreign experts. The European consortium rolling mill deal was shelved. There was no news on a steel tubing plant to be built by the West German firm, Mannesman A.G., and a large sintering and pelletizing plant which the Japanese firm, Hitachi Shipbuilding Co., was negotiating to construct. A wire rod mill was installed by the Japanese firm Kobe Steel a few years ago. The Austrians finally turned over the Linz-Donawitz (LD) oxygen converters they were building for the Taiyuan steelworks.

Mainland China has always had trouble making complicated steel products, such as pipe, tinplate, hot and cold rolled sheet and coil, and special steels. To supplement domestic supply, sizable tonnages have been imported, even during recent years. From Japan alone, 1968 imports totaled 1,028,000 metric tons, including about 418,000 tons of sheets and plates, 276,000 tons of tubes and pipes, and 268,000 tons of bars and rods. Japanese steel producers estimate that their total exports to mainland China in 1969 might be as high as 1.3 million metric tons.

Some progress has been made in equipment manufacturing. The Chinese can build blast and open hearth furnaces, but not the conventional-type oxygen converters. In 1968, a 1,000-ton-per-day sintering plant was built at Tangshan. Mainland China's first locally made galvanizing facility reportedly was completed at Sian, and various automatically controlled electric furnaces were put into operation.

Anshan, a large integrated steel center by world standards with 10 blast furnaces ranging in size from 585 to 1,513 cubic meters and 25 open hearths, had been capable of producing about 6 million tons of steel ingot annually. With no work disruptions since August 1967, 1968 was a good year for Anshan, the mainstay of the Chinese steel industry. All output targets were reportedly fulfilled well ahead of schedule; monthly output levels in the second half of 1968 were, in fact, greater than the average monthly rate in 1966. It might be surmised that capacity output probably was achieved. Further, production in January 1969 reportedly surpassed the production level of December 1968. Technically, many advances were reported for Anshan. Various methods of fuel injection into blast furnaces were introduced, including slurry coal, coal dust-heavy oil mixture, and tar and coal gas, to bring down coke consumption and improve smelting efficiency. A record of 104 heats before relining the bottom was set at the No. 17 open hearth furnace. Hundreds of new products were trial-manufactured at the seamless tube mill and other plants.

The Wuhan steelworks, with two blast furnaces (one, 1,386-cubic meters and one 1,436-cubic meters), five open hearths (four 500-ton and one 250-ton), three byproduct coke plants, and various rolling mills, had been rated at about 1.5 million tons of steel ingot annually for its "first stage" capacity. A third large blast furnace was near completion at yearend 1968. Production at Wuhan hit its stride briefly in 1966. Political trouble, at times involving fighting, on at least three subsequent occasions —early 1967, mid-1967, and mid-1968— hindered operations during most of 1967 and half of 1968, but Wuhan reportedly achieved record output during the last quarter of 1968.

The Shihchingshan-Tangshan-Tientsin-Peiping complex, with an annual capacity of more than 1.5 million tons of steel,

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had another fairly good year. Shihchingshan, with three blast furnaces (413, 512, and 963 cubic meters), three coke units, and top blown oxygen converters, has been the key in this complex. Injection of anthracite dust along with other fuels was successfully done at Shihchingshan.

Facilities at the Paotou steelworks included a 1,515-cubic-meter blast furnace, a sintering plant, byproduct coke plants, possibly two 600-ton open hearths, and rolling mills. Paotou underwent a great deal of strife in 1967, but settled down in early 1968. A steady rise in production followed, and the 1968 targets for finished products as well as raw materials were fulfilled ahead of schedule. Paotou tested a rail and beam plant at yearend. Apparently, operations were finally normalized, although considerable basic construction probably still needs to be done.

The Taiyuan steelworks was under construction when the Cultural Revolution began. Five blast furnaces (963 and 291 cubic meters plus three smaller ones) and various steel furnaces, including open hearths, electric furnaces, and converters had already been installed, while some rolling mills were not quite finished. The steelworks was "seized" briefly in early 1967, but went through a peaceful year in 1968. The Austrians finally completed two 55-ton LD furnaces for Taiyuan, which should be ready to start operations early in 1969.

Chungking with three blast furnaces (the largest being 620 cubic meters) and all the necessary steel production equipment was rated at about 1 million tons of steel ingot per year. A somewhat outmoded steel plant, Chungking was not mentioned in the press as doing well in 1968. Early in 1969, however, Chungking apparently reestablished normal operations.

Shanghai, mainland China's second ranking steel center in terms of overall output, reportedly fulfilled 1968 targets well ahead of schedule. At least eight small plants were in existence. Only a small part of the pig iron was produced in Shanghai, with much of the rest possibly coming from nearby Maanshan steelworks in Anhwei. Shanghai No. 1 was the most important plant, with two 255-cubic-meter blast furnaces, two 70-ton open hearths, six 8-ton Bessemer and Thomas converters, two 30 to 35-ton "homemade" oxygen converters (installed in late 1966), a slabbing mill, a medium plate mill, and a forging mill, among others. It was claimed that the Shanghai No. 3 plant did particularly well in the latter half of 1968, with daily output of converter steel, electric steel, steel castings, and other products topping all previous records. Maanshan had 13 small blast furnaces ranging from 34 to 225 cubic meters in size, some open hearth furnaces, and a heavy rolling mill. Shanghai and Maanshan together probably can produce 2 to 3 million tons of steel annually.

The Penchi (Penhsi) complex of some 22 mines and plants became fairly integrated, with the addition of rolling mills and new steel furnaces, mostly electric, to complement the iron, coal, and refractory mines, the coke ovens, and the blast furnaces. Roughly on a par with Taiyuan and Chungking in size, Penchi fulfilled 1968 targets well ahead of schedule, and produced many new products, particularly special steels and high-grade alloy steels. Various techniques were adopted, including automatic control devices for electric furnace operations.

Lead and Zinc.—The contract signed with the British firm Imperial Smelting Process, Ltd., in 1966 to use the ISP process in building a lead-zinc plant at Shaokuan in northern Kwangtung was apparently not yet implemented by 1968, because of internal confusion. Apparently, the plan was to produce 35,000 to 40,000 tons of zinc and 18,000 to 20,000 tons of lead annually.

Second quarter zinc output at Shuikoushan, a well-known old lead-zinc mine in Hunan Province, was reportedly more than double that of the first quarter.[8] It was further claimed that the mine was converted in a few years' time into a modern operation capable of producing "hundreds of times" the pre-"Liberation" level, which was obviously nominal.

For the country as a whole, zinc was in short supply and the Chinese were interested in buying 10,000 tons annually from the Japanese.

Magnesium.—Chinese negotiations with Furukawa Magnesium Co. of Japan to help build a 3,000-ton-per-year plant fell through. Meanwhile, mainland China continued to produce about 1,000 tons of magnesium annually from an old plant

[8] Ta-kung-pao (Peiping). Sept. 1, 1968, p. 1.

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which was built during the Japanese occupation.

Manganese.—Chinese manganese ore output ranked about fifth in the world, although production still had not returned to the 1966 level. Improved conditions in steel smelting should raise future demand for manganese somewhat. Hsiangtan in Hunan, Mukwei and Leiping in Kwangsi, Chin Hsien and Fangcheng in Kwangtung, Tsunyi in Kweichow, and Wafangtzu in Manchuria were the main producers. A small surplus was exported.

Mercury.—Although mercury output probably was no more than in 1967, the country was still prominent among world producers. Southwest China, particularly Tungjen in Kweichow, produced the bulk. The Soviets took about 35,000 flasks of Chinese mercury in 1962, as compared with approximately 1,000 flasks annually in 1966–67. Many countries now import mercury from China, but all in small quantities, including about 400 flasks imported by Japan in 1968.

Molybdenum.—The Chinese had not yet fully developed several large molybdenum deposits; however, for some time hundreds of tons of concentrates have been exported yearly from existing mines.

Tin.—The Soviet Union imported 17,400 long tons of Chinese tin in 1960 and only 100 tons in 1967. Accountable free world imports from mainland China have declined from 5,000 to 7,000 tons annually in 1962–65 to only about 3,000 tons in 1967–68. In recent years, annual tin consumption within the country has been variously estimated at 5,000 to 7,000 tons. Facilities for making tinplate were still inadequate, and large purchases had to be made from Japan and elsewhere. For 1968 combined tin output from the two tin centers of China—Kuchiu in Yunnan and Fuhochung in Kwangsi—has been estimated at 20,000 tons. Apparently, considerable tin has been stockpiled in recent years. Japanese merchants believe that Chinese tin exports were about to achieve a phenomenal revival in free world markets.

Titanium.—A few years ago, the Chinese were exploring the possibility of purchasing a titanium plant from the Japanese. During 1968, Japan exported 3,077 metric tons of titania (TiO_2) to mainland China worth about $1 million, indicating the need there for white pigment.

Tungsten.—Despite higher prices, Chinese exports of tungsten concentrates declined in recent years. In 1960 the Soviet Union imported 18,900 metric tons of tungsten concentrates from mainland China but after the Sino-Soviet rift, it only imported 600 tons in 1967. Contrasting this, free world imports have risen from 2,000 tons in 1964 to 8,000 tons in 1966 and 7,000 tons in 1967. According to the United Nations Conference on Trade and Development (UNCTAD) Committee on Tungsten, total tungsten imports by the free world from China in 1968 seem to have been lower than the tonnage in 1967. For the past 3 years total tungsten production by mainland China, mainly wolframite from Kiangsi Province, has been estimated at about 15,000 metric tons of concentrates or roughly 8,000 tons of tungsten content—some 25 to 30 percent of the world output. Three-quarters of the 1966 output was exported, as compared with less than half of the 1967 output. This suggests more stockpiling within the country. Some merchants feel that the high calcium content of certain Chinese tungsten concentrates recently offered for sale (possibly scheelite from Hunan Province mixed with high-grade wolframite) makes marketing difficult. Others believe that the Chinese might well make a serious effort to sell more in the forthcoming Canton Fair.

Uranium.—On December 27, 1968, mainland China exploded its second hydrogen bomb, which was the seventh nuclear test since October 16, 1964. This latest fusion-type explosion, again taking place at Lap Nor in Sinkiang Province, followed an earlier one on June 17, 1967, and five fission-type nuclear blasts. The Chinese have also been working on warhead devices. Two plutonium reactor plants apparently were in existence. However, in the last two tests, uranium-235 was used to set off fusion rather than the more conventional plutonium. The proceessed uranium-235 came from a gaseous diffusion plant near Lanchow in Kansu. A large hydroelectric facility nearby furnished the power for the Lanchow plant. By choosing this technological route, mainland China probably shortened its nuclear schedule and assured lower future costs.

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Maishan and Chushan in Chuannan of Kiangsi Province and Hsiachuang of Weiyuan of Kwangtung Province constitute three of the newer uranium mines. Beneficiation and processing facilities have been built at Chuchou in Hunan with Czechoslovakian assistance.

Nuclear development in mainland China reportedly had been temporarily slowed down by military intervention in scientific affairs to which scientists objected.

Other Metals.—Various rare-earth metals and alloys for use in the optical, metallurgical, and nuclear energy industries were produced at Chinchow in Manchuria and elsewhere. In recent years, the China National Metals and Minerals Import and Export Corporation had offered selenium and gallium of 99.99 percent purity for export.

NONMETALS

Asbestos.—Production of asbestos—mainly long fiber, chrysotile type—has been increasing in recent years. The Cultural Revolution, however, has held down production temporarily to possibly 150,000 tons per year. Nonetheless, mainland China probably ranked within the first five world producers in 1968, providing possibly 4 percent of the world total. The bulk of the output came from Shihmien in Szechuan, where a dozen new projects were completed recently, and a new large and high-grade orebody was reportedly discovered. Normally a small exporter, mainland China made inquiries in 1968 about importation of Canadian asbestos. Chinese and Canadian asbestos experts have exchanged visits, and the Chinese were interested in buying Canadian beneficiation equipment for Shihmien.

Barite.—Barite production may have attained a record 120,000 metric tons in 1968, because of the accelerated domestic oil drilling program. This would represent 2 to 3 percent of the world total. The industry apparently has good potential for expansion. Meanwhile, there seemed to be a temporary shortage, because Japan, the principal purchaser of Chinese barite abroad during 1966–67 (37,680 tons in 1966 and 26,695 tons in 1967), did not take any in 1968. Poland imported about 3,000 tons of barite from China in 1967.

Boron Minerals.—A surplus of borax continued, although no specific information was available on the extensive boron-bearing lake deposits in the Iksaydam area of Tsaidam, Tsinghai Province.

Cement.—Cement production still had not returned to the 10-million-ton level by 1968, although an increase over 1967 production was apparent. After a fairly successful year in 1966, the entire cement economy was bady disrupted by the Cultural Revolution, from raw materials to production, distribution, and consumption. The upturn in 1968 was less spectacular than in many other industries, because construction activities were slow in getting started again. An indication of adverse supply within China was that imports by Hong Kong—the main purchaser of surplus Chinese cement—declined from 690,000 tons in 1966 to 390,000 tons in 1967, and only about 132,000 tons during the first 11 months of 1968.

More than half of the approximately 50 large and medium-sized cement plants (100,000-ton to 1-million-ton annual capacity) were mentioned in the Chinese press during 1963–66, and it was claimed that about a dozen modern plants and some 100 very small plants had been built during this period. The World Cement Directory[4] lists the known Chinese plants and their capacities. Some of the newly built larger ones were Tatung in Shansi, Kunming in Yunnan, Yao Hsien in Shensi, Yungteng in Kansu, Chungking in Szechuan, Kwangchow in Kwangtung, Liuchow in Kwangsi, Kweiyang in Kweichow, Mutanchiang in Kirin, and Nanping in Fukien. Hardly any new plants were reported for 1967.

Domestically designed and built, China's largest modern cement plant—Hantan (south of Shihchiachuang) in Hopeh Province, rated at possibly 1 million tons annual capacity—went into operation in late 1968.[5] According to the New China News Agency, a 300,000-ton-per-year rotary kiln constructed by the Lanchow Petrochemical Machinery Plant in Kansu and placed in production in early 1968 became China's largest operating kiln. The Tungfeng in Huangshih (Hupeh), the Red Flag in Sian (Shensi), and the Tsinan in Shantung were among cement plants mentioned as

[4] CEMBUREAU, The European Cement Association. (Paris). World Cement Directory. 1965, pp. 64–67.
[5] Ta-kung-pao (Peiping). Nov. 15, 1968, p. 1.

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having done well in 1968. The Chaohu cement plant in Hofei, Anhwei illustrates what the cement industry as a whole probably went through. After a Revolutionary Committee was formed in August, Chaohu's monthly cement output reportedly increased 78 percent in September, 69 percent in October, and 24 percent in November. This indicates that performance in the first half of 1968 was very bad, whereas output by the last quarter had attained high levels.

Diamond.—Commercial production of synthetic diamonds apparently commenced at a metallurgical plant in Tsingtao, Shantung, in mid-1968, after a period of successful experimentation.[6] Proud of their achievement, the Chinese communists noted that few countries have the capability to make synthetic diamonds.

Changte in the Yuangchiang Basin of western Hunan is the only diamond mine known to have been worked in China. Reportedly, diamond deposits have also been found in Kweichow and Shantung Provinces.

Fertilizer and Chemical Materials.—The highest estimate for fertilizer production within mainland China during any year has been about 10 million metric tons and the lowest, approximately 5 million tons. Nonchemical fertilizers, such as ground phosphate rock, were undoubtedly included in the figures. A reasonable guess for production of chemical fertilizers by China during 1968 is 6 to 8 million metric tons. One source[7] describing the fertilizer industry in some detail indicates that about a dozen common types of chemical fertilizers were being produced. Possibly 250 plants were in existence, including perhaps 150 small nitrogenous fertilizer plants using a process designed by the Vice Minister of Chemical Industry. Three-fourths of the national output was said to be nitrogenous and one-fifth phosphatic. Small plants accounted for about a third of national capacity. Nanking, Kirin, Chuchow, Luchow, and Canton were among the newer large plants.

Mainland China needs much more fertilizer than it can produce. Apparently, the country purchased 5.5 to 6.5 million tons of chemical fertilizers in 1968, compared with roughly 5 million in 1967, 3.5 million in 1966, and 2.5 million in 1965. One source[8] indicated that China contracted with the European consortium of NITREX to obtain 3.4 million metric tons of ammonium sulfate equivalent, valued at more than $100 million for delivery between June and December 1968 and, if necessary, extended into early 1969, because of the harbor handling difficulties in coastal China. A year ago deliveries from Europe were less than contracted, partly because of the closing of the Suez Canal. The Japanese contracted to deliver about 2.4 million tons of ammonium sulfate equivalent in 1967, and possibly 2.7 million in 1968 at roughly $38 to $40 per ton c.i.f. Actual Japanese trade returns, however, account for only 1.74 million tons valued at $65 million in 1967 and 1.76 million tons valued at $75 million in 1968. Breakdown of Japanese fertilizer exports to mainland China was as follows, in thousands of metric tons: 1967—ammonium sulfate, 974; urea, 422; and ammonium chloride, 320; and 1968—ammonium sulfate, 747; urea, 655; and ammonium chloride, 335. In addition, China imported 750,000 tons of phosphate rock from Morocco in 1967 and more than half a million tons during the first 10 months of 1968. Late in 1968, the Canadians were hopeful that potash could be sold to mainland China in the future.

Pyrite production of perhaps 1.5 million tons which came mainly from Hsiangshan in Anhwei and Yingte in Kwangtung and byproduct sulfur from nonferrous ores were used in sulfuric acid manufacture. Additional pyrite was produced in Szechuan and Shansi Provinces, but output is not included in this estimate, since this pyrite was converted to about 250,000 tons of elemental sulfur, a part of which was ultimately exported. Phosphate rock production was about 1 million tons in 1968, coming mainly from Chinghsiang in Hupeh, Kaiying in Kweichow, and, to a lesser extent, Liuyang in Hunan and Nantung in Kiangsu. Mainland China not only imported phosphate rock, but also some apatite from Laokay, North Vietnam.

Fluorspar.—Chinese fluorspar production was perhaps 7 to 8 percent of the world total. Output from Chekiang and North

[6] New China News Agency (International Service in English: Peiping). July 23, 1968, p. 1.
[7] Chemical Engineering. V. 75, No. 12, June 3, 1968, pp. 44–46.
[8] NITROGEN, British Sulfur Corp., Ltd., (London). July–August 1968, pp. 1–2.

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China remained steady, but Kwangsi Province has become a significant new source. The bulk of the fluorspar has been traditionally exported. During 1967, importing countries gave the following figures, in metric tons: Japan, 129,291 (111,240 in 1968); U.S.S.R., 38,300; West Germany, 12,789; Poland, 8,545; Netherlands, 8,142; and Belgium, 1,327. The Kamaisho Co. of Tokyo contracted all fluorspar imports from mainland China for Japan. Within China, fluorspar was consumed in the manufacture of steel, aluminum, and ceramics, and in uranium processing.

Magnesite.—Southern Manchurian magnesite found in a belt extending from Tashihchiao northeast to Lienshankuan continued to be of great world significance. Output in 1968, although more than that in 1967, probably was still below the million-ton level. Requirements for refractories by the steel industry did not reach high levels until the second half of 1968. Anshan steelworks has pioneered the use of magnesia-alumina bricks for iron and steel smelting in China. Large amounts of magnesite and calcined magnesia have been traditionally available for export.

Salt.—Mainland China retained its position as the second largest producer of salt, after the United States. Apparently, a record output of possibly 15 million metric tons was achieved in 1968. The Chinese Communists claim that the target for salt production in 1968 was fulfilled more than 3 months ahead of schedule, and that the 1967 quota was met as well.[9] Operating conditions were excellent for all four main sea water salt producing provinces, with individual output considerably higher than last year. Many specific salt fields were mentioned in the press as having done well, including Tangku in Hopeh, Chintan and Nantung in Kiangsu, Yangkou and Tsingtao in Shantung, Yingko and Fuchouwan in Liaoning, and smaller fields in Hainan and Tsinghai. The Tangku, Fuchouwan, and Yangchiaokou saltfields were specifically cited as establishing record highs.

Although most salt was consumed for food purposes, industrial demand was rising. In fact, the Chinese Communists were considering building more chemical works to use salt. Traditionally, surplus salt has been exported, principlly to Japan. About 1 million tons went to Japan in 1968, and contracts for future delivery to that country have been of this magnitude. The Chinese salt industry produced many byproducts, such as potassium chloride, bromine, boric acid, iodine, and barium chloride. Most of this byproduct output comes from the inland area of Tsinghai, where lake salt is produced instead of the usual sea-water salt. Tsinghai reportedly had topped 1967 output by 32 percent and fulfilled the 1968 target by September;[10] this also implies more salt byproducts.

Steatite and Talc.—Chinese steatite and talc from Taling in Liaoning Province are world famous. Between one-third and one-half of the 1968 output was exported, with Japan the main purchaser taking 30,961 tons of steatite and 26,262 tons of talc. The U.S.S.R. imported a combined 17,600 tons of steatite and talc from China during 1967.

MINERAL FUELS

Coal.—For the most part, the coal industry had a relatively peaceful and stable year. There was still considerable trouble at many times in late 1967 and early 1968, but by yearend the Chinese Communists claimed[11] that 68 of the country's 71 principal coal mines, with more than 1 million workers, had Great Revolutionary Alliances in control. The crippling transport bottleneck created by the Cultural Revolution was finally eased, although coal shortages were still noted for the fall of 1968 in view of campaigns to conserve coal.

Thus, the Chinese coal industry had substantially recovered from the catastrophe of the previous year. In fact at the turn of 1969, record high monthly outputs were claimed for many mines. These advances, nevertheless, did not make up for the poor to mediocre performances in early 1968, when many Alliances were first organized and the first of two 1968 National Coal Conferences was held. No national coal output figures, even in terms of percentages, were reported for 1968, although the tonnage in the second half probably was a half-year record for the last 5 years. It might be surmised that output in all of 1968 was still slightly below the 1966

[9] New China News Agency (International Service in English; Peiping). Oct. 30, 1968, p. 1.
[10] Jen-min Jih-pao (People's Daily; Peiping). Sept. 23, 1968, p. 1.
[11] Ta-kung-pao (Peiping). Dec. 30, 1968, p. 1.

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level and output in 1969 could well top that for 1966, a record high year.

The National Coal Conferences, political as well as technical in nature, were necessary from the viewpoint of returning the coal industry to normal operations. Chaos still existed in early 1968, when Alliances were established at the mines. Coal production greatly increased soon after the first conference, held around June. For example, July output was said to have been 160 percent more than that of June, and August output was 25 percent more than that of July. A second conference was held at the Fengfeng coal mine, Hopeh Province, in November. This conference was more technical, two of the technical slogans concerned streamlining tunneling and conserving mine timber; yet, extolling the achievements of the Alliances was still a prominent part of the deliberations. It was flatly stated that production at many coal mines in 1968 had surpassed the levels in 1966.

Numerous coal mines were claimed to have fulfilled their 1968 output goals, as follows when available the number of days ahead of schedule is in parentheses: Kailan (14), Fuhsin (10), Tatung, Chihsi (10), Huainan, Shuangyashan (71), Fengfeng (48), Penchi (31), Peipiao, Liaoyuan, Chinghsing, Peking, Chiaotso (16), Hopi, Tzepo, Tsaochuang, Yangchuan, and many mines in Inner Mongolia, Manchuria, and southern China. It was also claimed that the combined average daily output rate of coal mines directly under the Ministry of Coal Industry (all the big mines) during the fourth quarter of 1968 was a record high for recent years (probably meaning the 1960's).

Kailan's output was said to have been increasing since October 1967, with the tonnage in 1968 topping that in 1965 by 13 percent. Fushun had trouble early in the year, but second quarter output was claimed to have been 70 percent greater than that of the first quarter; the third and fourth quarters showed further gains and at yearend, monthly production established record highs. Overall, Fushun output was not far behind the target for 1968. Tatung was also producing at a record high pace during the last few months, after some trouble early in 1968. Huainan had political disturbances as late as the first quarter, but managed to surpass its annual target. Fuhsin and Chihsi produced at an even pace, after settling their mild clashes in late 1967. Hokang, the only other Chinese coal mine normally producing more than 10 million tons annually, did not resolve its political problem until late in the year, as evidenced by the claim that output during October 1-8, 1968, was 46.7 percent more than the corresponding period in September. After 6 months of civil war in 1967 and continued unrest during much of 1968 until the formation of the Alliance, the large and recently developed Pingtingshan Coal Mine at yearend finally surpassed the previous daily output high and was heading for a new production plateau. Record high outputs were also reported for various smaller mines, including Chiaotso in Honan.

Major coal deposits reportedly were discovered south of the Yangtze River in Hunan Province. This is significant because all large coalfields previously found in China have been in the north. There was news about capital construction in the coal industry too. More new coal pits were said to have started production in 1968 than in 1966. A "fully mechanized" modern shaft coal mine, with a capacity of "hundreds of thousands of tons" went on stream in Hsingtai, Hopeh Province, late in the year. A 600,000-ton coal mine was also completed in the Chiehfa mining center of Liaoning Province. A large shaft mine of several hundred thousand tons was opened up in Sinkiang. Another news item reported that an hydraulic coal operation with a corresponding coal preparation plant of 3-million-ton capacity was started at the Luchiatun mine of Kailan Administration.[12]

Petroleum.—Record oil output was apparently achieved in 1968, despite some labor trouble at Taching—mainland China's foremost field—early in the year. Production of both refined and crude oil topped the 1966 levels slightly and the 1967 levels, considerably. There was reason to believe that previously estimated oil outputs for the country may have been on the low side. Additional oil resources were also uncovered. The first deep oil drilling rig was successfully tested. There was more drilling in most of the fields. Refining facilities were expanded at Taching and elsewhere. Mainland China was reported

[12] Ta-kung-pao (Peiping). Aug. 17, 1968, p. 2.

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to have four petrochemical plants: Taching (Lungfeng), Shanghai, Lanchow, and Fushun.

Taching was prominent in the news in 1968.[13] Crude production at this field topped the "Third 5-Year Plan" target 2 years ahead of schedule. Construction and development were pushed in anticipation of a "leap forward" in 1969. Large-scale drilling apparently begun in 1963 was virtually completed in 1968, with perhaps 1,000 wells in operation. Expanded operations at Lungfeng, Taching's refinery between Anta and Saerhtu, still were not processing all of the crude from the nearby oilfield. Surplus crude oil was sent to Dairen, Fushun, Lanchow, Shanghai, and Maoming for refining. If not already a fact, Taching's crude output may soon be pushing 10 million metric tons per year. The Peking Petroleum Institute moved to Taching in mid-1966.

There was no additional news about the Shengli (Victory) field in Shantung, that is possibly located near the mouth of the Yellow River. During the early stages of development, it was thought that this oilfield had the potential to rival Taching's output. Another oilfield of possible future importance was reportedly discovered at Shashih in Hupeh, west of Tayeh.

A Great Revolutionary Alliance was formed at the Karamai oil complex in Sinkiang—including the oilfields and refineries at Karamai and Tushantzu—on March 25, 1968, to normalize operations. The year's targets, including output of crude and refined oil and the footage of drilling, reportedly were fulfilled ahead of schedule.[14] In 1966 annual production of perhaps 2 million tons was achieved through drilling new oil wells, rejuvenating abandoned wells, and improving the spacing of wells. Output in 1968 appeared to be at least as high as that of 1966.

Output of the old Yumen field in Kansu reached an alltime high in 1968 of probably over 2 million tons. "Bloody clashes" were brought to an end in 1967, and Chinese Communists claim that production of crude during every month in 1968 topped quotas—unprecedented in the history of Yumen oilfield—and that daily output at yearend was 70 percent greater than that prior to the Cultural Revolution. Yumen's refinery also did well, but surplus crude was shipped to Lanchow as in the past.

As an aftermath to an armed clash in August 1967, Revolutionary Committee for the Lanchow Refinery was set up in January 1968. Lanchow reportedly produced at record tonnages in 1968, with targets for all major refined products fulfilled a month ahead of schedule.[15] Lanchow with an annual capacity of perhaps 2 to 2.5 million tons has many kinds of facilities, including urea and petrochemical plants.

Shanghai, which has a large refinery with thermal cracking and platforming units, has also become an important center for manufacturing oil refining and drilling equipment. The Shanghai refinery had its share of troubles, but it apparently was working at capacity in 1968. Crude came primarily from Taching via Dairen, with some from the new Shengli field. The Fushun refinery, with two major units originally designed to process shale oil and probably additional facilities for treating regular crude, was operating at capacity at least in the latter half of 1968; crude oil from Taching was refined here, along with shale oil. Shale oil extraction was temporarily stopped in 1967. The premise that a refinery was operating at Mowming in Kwangtung was strengthened by statements suggesting that Taching crude was shipped to that location for refining. The Chinchou synthetic oil plant in southern Manchuria apparently was still operating.

Mainland China has started to look into offshore exploration and drilling for oil. Since South China is short of oil, offshore work might have commenced along the coast of Kwangtung and Hainan. Reportedly, offshore equipment was purchased from West Europe and Rumania.

[13] Ta-kung-pao (Peiping). Jan. 5, 1969, p. 1.
[14] Ta-kung-pao (Peiping). Dec. 27, 1968, p. 1.
[15] Jen-min Jih-pao (People's Daily; Peiping). Dec. 10, 1968, p. 1.

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The Mineral Industry of Colombia

By Gordon W. Koelling[1]

In 1968 Colombian production of many metals and nonmetals registered gains, but production of oil and gas declined. The country continued to be the world's principal source of emeralds, ranked about eighth in gold production, and was the only producer of platinum in South America. However, the output of these items was not as important to the national economy as the production of commodities such as crude oil, iron ore, limestone, cement, and salt.

The loan agreement with the U.S. Agency for International Development (AID), under which the National Minerals Inventory was initiated, was extended beyond its scheduled 1968 expiration date. This was done in order to permit the completion of field investigation work, especially core drilling. A mid-1969 target date was set for the completion of this project.

On March 1, 1968, the Colombian Government issued a decree to implement the new mining law enacted in 1967. This decree granted the Ministerio de Minas y Petróleos authority to set royalties, varying from 3 to 8 percent, on the mining of base metals. However, it specified that mining operations could not be required to pay royalties until their annual production level reached 30,000 tons in the case of native mercury ore; 150,000 tons of iron, lateritic nickel, titanium, and bauxite ores; or 100,000 tons of other classes of base metal ores including sulfurous mercury and nonlateritic nickel. The decree also specified that mining companies must process their output within the country to the extent that this is technically and economically justified and must give preference to supplying the needs of domestic consumption and the demands of local metallurgical plants.

A bill sent to the Colombian Congress by the President in December 1968 would provide for the cancellation of mining rights held by private concerns if: (1) within 3 years the titleholders have not explored the deposits to determine probable reserves and average mineral content; (2) within 5 years the titleholders have not begun exploitation of the deposits; (3) once started, exploitation is suspended for more than 1 year except as a result of *force majeure* or other justified cause. This bill would also authorize the Government to declare as a national reserve any territory that offers petroleum possibilities. Such areas would be reserved for the Government-owned oil company, Empresa Colombiana de Petróleos (ECOPETROL), to explore and exploit directly or in association with other investors. Petroleum concessions in force and concession applications made prior to passage of the law would not be affected.

A Presidential decree issued around the end of the year which reorganized the Ministerio de Minas y Petróleos, by creating several new departments to expedite action on mining and petroleum concession applications. This decree also directed the Ministry to formulate an official policy on exploration, exploitation, refining, transportation, and distribution of minerals, petroleum, and their respective derivatives.

[1] Geographer, Division of International Activities.

Table 1.—Colombia: Salient statistics

	1964	1965	1966	1967	1968 p
Gross national product (GNP)---millions	$3,691	$4,121	$5,084	$5,534	$6,100
Index of mineral industry production [1] (1958=100)	NA	146.5	140.9	138.5	NA
Value total exports---millions	$548	$539	$508	$510	NA
Value mineral commodity exports---do	$89	$104	$90	$82	NA
Value total imports---do	$506	$454	$674	$497	NA
Value mineral commodity imports---do	$80	$63	$112	$51	NA

p Preliminary. NA Not available.
[1] Crude minerals only.

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PRODUCTION

Although the performance of the various sectors of Colombia's minerals industry was mixed, a majority of the commodities produced showed an increase in output. Production of iron ore, lead, limestone, cement, salt, natural gas liquids, and refinery products rose significantly, but the output of pig iron was down slightly, and production of gold, silver, crude oil, and natural gas declined sharply.

Table 2.—Colombia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Chromium: Chromite, gross weight	400	260	-------	-------	-------
Gold, metal, troy ounces	364,991	319,362	280,823	257,668	237,480
Iron and steel:					
Iron ore and concentrate, thousand tons	710	706	662	807	1,075
Pig iron, do	205	204	169	207	199
Steel ingots and castings, do	230	242	217	252	265
Lead, mine output, metal content [e]	484	460	597	608	740
Mercury, 76-pound flasks	3	46	[r] 89	210	285
Platinum group metals, troy ounces	20,647	11,141	15,671	12,411	15,076
Silver [2], do	130,666	115,866	[r] 106,757	110,442	100,344
Zinc, mine output, metal content [e]	100	48	300	506	575
NONMETALS					
Barite	10,200	8,800	[r e] 7,400	6,007	7,570
Cement, hydraulic, thousand tons	[r] 1,965	[r] 2,053	[r] 2,074	2,114	2,367
Clays:					
Kaolin (including china clay), do	81	83	26	11	18
Other, do	472	1,837	1,384	527	589
Diatomite	231	200	-------	-------	-------
Feldspar, thousand tons	12	11	19	18	22
Gem stones: Emerald, thousand carats	[e] 269	[r] 444	[e] 329	256	NA
Gypsum, thousand tons	108	112	115	[e] 78	NA
Lime, do	100	108	50	876	915
Magnesite	220	190	[e] 190	[e] 190	NA
Mica, all grades	-------	-------	-------	2,911	3,275
Quartz, quartzite, and glass sand, thousand tons	135	150	9	37	43
Salt:					
Rock, do	289	280	301	310	317
Marine, do	51	51	81	159	NA
Total, do	340	331	382	469	NA
Stone, n.e.s.:					
Dolomite, do	3	12	6	12	17
Limestone, do	4,278	3,890	3,281	3,351	3,937
Marble, cubic meters	650	1,700	1,000	3,665	4,395
Sulfur, elemental	12,184	18,405	20,980	24,000	28,750
Talc, soapstone, and pyrophyllite	730	400	1,195	[e] 1,000	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades, thousand tons	5,000	3,100	[r] 2,500	3,100	[e] 3,000
Coke, all types, do	420	[3] 470	323	111	228
Fuel briquets, all grades, do	-------	-------	-------	14	16
Gas, natural:					
Gross production, million cubic feet	84,687	93,823	98,096	99,920	94,837
Marketed, do	26,919	31,738	35,922	37,721	41,537
Natural gas liquids, thousand 42-gallon barrels	1,658	1,636	2,079	2,914	4,300
Petroleum:					
Crude oil, do	62,596	72,670	71,430	68,877	63,435
Refinery products: [4]					
Gasoline and naphthas:					
Aviation gasoline, do	540	786	784	746	684
Motor gasoline, do	11,312	[r] 12,381	13,132	13,277	13,842
Naphthas, do	7	177	187	463	2,344
Kerosine and jet fuel:					
Kerosine, do	1,793	1,940	2,102	2,540	2,958
Jet fuel, do	195	244	396	526	835
Distillate fuel oils, do	4,123	4,437	4,849	5,629	7,480
Residual fuel oil, do	8,742	10,884	12,157	14,904	16,501
Liquefied petroleum gases, do	485	[r] 890	[r] 655	862	1,183
Lubricants, do	372	448	480	415	423
Asphalt and bitumen, refinery, do	1,827	1,494	1,521	1,178	1,668
Petroleum coke, do	540	603	607	708	896
Other, do	[r] 2,600	[r] 1,538	[r] 1,184	1,648	1,415
Total, do	[r] 32,536	[r] 35,822	[r] 38,054	42,886	50,229

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] Carbon black and fertilizer materials are also produced, but level of output is unknown.

[2] Reported by Banco de la Republica as precious metal refinery output.

[3] Includes 35,000 tons of coke breeze.

[4] Includes refinery fuel.

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TRADE

The value of Colombia's mineral commodity exports in 1967 was 9 percent less than during 1966 and 21 percent below the 1965 total. Petroleum, primarily in the form of crude oil, accounted for 91 percent of the 1967 total. Approximately 42 percent of all mineral shipments went to the United States. Other important markets were Trinidad and Tobago, Venezuela, and Peru.

The total value of mineral imports declined 54 percent during 1967, primarily as a result of the 45-percent drop in iron and steel imports and a fairly general decline in receipts of other metals. The United States was the source of about one-fourth of Colombia's mineral commodity imports. Other important sources included Japan, West Germany, Canada, and the Netherlands Antilles.

Table 3.—Colombia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	143	259	Ecuador 190; Nicaragua 52.
Copper, scrap	10	121	Ecuador 112; Guatemala 7.
Iron and steel:			
Scrap	100	-------	
Semimanufactures	1,427	2,451	Ecuador 777; United States 535; Venezuela 376; Nicaragua 276.
Lead, ore and concentrate	1,175	429	Venezuela 259; Costa Rica 127.
Platinum, metal, troy ounces	-------	14,214	All to United States.
Zinc, ores and concentrate	-------	1,073	Sweden 875; Venezuela 75.
Ores and minerals, not further specified	15	-------	
NONMETALS			
Cement	181,325	229,955	Puerto Rico 82,236; Brazil 39,696.
Clays and clay products:			
Crude: Kaolin and other clays	29	96	Honduras 42; Venezuela 35.
Products:			
Refractory	122	182	Venezuela 96; El Salvador 29.
Nonrefractory	20	76	Ecuador 39; Venezuela 26.
Diamond, industrial, carats	40	NA	NA.
Fertilizer materials: Ammonia	43,448	21,470	Costa Rica 7,238.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all types	814	1,422	Venezuela 1,258; Ecuador 104.
Coke	-------	75	Ecuador 33; Venezuela 23.
Petroleum:			
Crude, thousand 42-gallon barrels	35,575	31,148	United States 11,831; Trinidad and Tobago 8,514.
Refinery products:			
Gasoline, do	175	-------	
Distillate fuel oils, do	289	-------	
Residual fuel oil, do	5,677	8,044	United States 5,793; Peru 1,026.
Other, asphalt, do	154	179	All to Ecuador.
Mineral tar and other coal, petroleum, or gas derived crude chemicals.	25,705	-------	

[1] In addition to reported commodities, Colombia is known to export gold, silver, and emeralds, but data are not available concerning shipments of these items.

Source: Analysis of Colombian Exports, 1963–67, Export Promotion Fund: DANE Export Tabulations, 1967.

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Table 4.—Colombia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite	9,009	5,988
Oxide (alumina) and hydroxide	226	431
Metal, including alloys:		
Ingots, castings and scrap	8,723	4,748
Semimanufactures	1,422	995
Antimony: Metal, including alloys	25	28
Copper:		
Copper sulfate	47	3
Metal, including alloys:		
Unwrought	6,114	3,068
Semimanufactures	869	885
Iron and steel:		
Ore and concentrate	339	417
Metal:		
Pig iron and scrap	11,511	5,895
Ferroalloys	3,528	2,670
Steel, primary forms	35,708	7,535
Semimanufactures	124,517	77,672
Lead:		
Oxide (litharge)	1,121	651
Metal:		
Unwrought	2,585	1,546
Semimanufactures	18	18
Magnesium metal, including alloys, unwrought	34	11
Mercury, 76-pound flasks	6	209
Nickel: Metal:		
Unwrought	69	41
Semimanufactures	344	89
Silver, metal, including alloys, troy ounces	r 56,000	13,825
Tin, metal, including alloys, all forms, long tons	277	135
Zinc, metal, including alloys, all forms	7,826	2,453
Other:		
Ore and concentrate	121	51
Metals, including alloys, all forms	36	2
NONMETALS		
Abrasives, natural, n.e.s.:		
Crude	321	59
Grinding stones and wheels	136	117
Asbestos, crude	16,534	13,752
Barite and witherite	11	8
Boron materials, refined borax	180	310
Cement	435	202
Clays and clay products:		
Crude clays, n.e.s.:		
Bentonite	3,117	1,405
NONMETALS—Continued		
Clays and clay products—Continued		
Crude clays, n.e.s.—Continued		
Kaolin	4,729	2,255
Refractory	15	6
Other	164	68
Products, refractory	1,075	2,562
Cryolite	3	6
Diatomite and other infusorial earths	945	920
Feldspar and fluorspar	19	43
Fertilizer materials:		
Manufactured:		
Nitrogenous	22,154	10,115
Phosphatic	28,148	21,529
Potassic	54,874	48,438
Other, including mixed	61,318	21,118
Graphite, natural	118	46
Gypsum	4,587	9,587
Lime	27	182
Magnesite	81	70
Mica:		
Crude	134	119
Worked	22	18
Pigments, mineral	452	168
Salt	84	7
Sodium and potassium compounds, n.e.s.:		
Caustic soda	43,077	24,758
Sodium carbonate (soda ash)	25,468	950
Stone, sand, and gravel:		
Dimension stone	158	200
Dolomite, chiefly refractory grade	3,559	3,293
Quartz	118	------
Sand and gravel	4	471
Sulfur	67	1,076
Talc, soapstone, and pyrophyllite	968	962
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	------	(1)
Carbon black	5,717	897
Coal, anthracite	------	1
Petroleum: Refinery products:		
Gasoline, thousand 42-gallon barrels	87	490
Kerosine and jet fuel, do	9	63
Distillate fuel oils, do	19	53
Lubricants, do	37	47
Mineral jelly and wax, do	263	164
Other	16	7
Mineral tar and other coal, petroleum or gas derived crude chemicals	643	815

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—During 1968, Kaiser Aluminum & Chemical Corp. acquired the discovery rights to bauxite deposits in the Department of Cauca. The company filed mining claim applications covering these deposits with the Ministerio de Minas y Petróleos, but these had not been processed at yearend. However, the Ministry was reportedly agreeable to Kaiser's proposal to develop the ore for export in crude form. Kaiser hoped to begin intensive prospecting early in 1969 in order to determine the economic feasibility of mining these apparently large and promising deposits.

Gold.—A gold production drop of 8 percent during 1968, the fourth consecutive year of declining output, resulted principally from rising production costs. A major portion of Colombia's gold output

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continued to be accounted for by a consortium of five companies owned or controlled by the International Mining Corp. (United States). Included in the production of these companies was the output from the country's only underground gold-mining operation at Frontino which accounted for over 25 percent of the Colombian total.

Banco de la República, the only entity which can legally buy or export Colombian gold, continued its established minimum purchase price of $35 per troy ounce with 50 percent of the sales value payable in U.S. dollars for expenditures abroad and remittance of profits. However, as a result of higher world prices for gold, local producers were informed that they would receive a price adjustment which would in effect raise the purchase price of all gold sold after June 1968 to approximately $39 per troy ounce. Gold producers were also entitled to receive the 15-percent incentive bonus normally granted to exporters.

Iron and Steel.—Acerías Paz del Rio, S.A., continued to be Colombia's dominant iron and steel producer during 1968. This company produced all of the country's pig iron from its own iron ore and accounted for a major portion of steel ingot and castings output.

The first-stage plant-expansion program of Acerías Paz del Rio, which was to raise that company's annual finished steel production capacity to 220,000 tons, was nearing completion at the end of 1968. New equipment installed as a part of this program included a sinter plant, a crushing and mixing plant, a turboblower, and an oxygen plant. Installation of a blooming mill and a reversing hot strip finishing mill originally scheduled for the same year was delayed owing to difficulties in importing replacement parts for equipment damaged in transport. Plans for a second-stage expansion program, which would raise annual capacity to 500,000 tons, stalled as the company continued its efforts to arrange the necessary financing.

Several small steel producers also had expansion programs in progress during the year. Empresa Siderúrgica de Medellín completed a 40,000-ton-per-year tinplate plant and began installation of a 40,000-ton-per-year electric furnace. Both Siderúrgica Muña and Corporación de Acero were installing 10,000-ton-per-year electric furnaces.

Nickel.—In February 1968, Standard Oil Co. of California and The Hanna Mining Co. submitted a preliminary report to the Colombian Administrative Planning Department concerning a project for working a lateritic nickel deposit near Cerro Matoso in the Department of Córdoba. This report proposed that the two companies establish an open-pit mine and a smelter with an annual capacity to produce 22,600 tons of ferronickel consisting of approximately 50 percent nickel and 50 percent iron. The project would require an investment of about $48 million. Negotiations were proceeding with the Colombian Government concerning taxes, royalties, and repatriation of capital.

NONMETALS

Fertilizer Materials.—Work was in progress at yearend 1968 to increase the 310-ton-per-day ammonia output capacity of the Amoníacos del Caribe (AMOCAR) petrochemicals plant at Mamonal by 65 tons per day. The new facilities, which were expected to cost approximately $500,000,[2] were scheduled for completion during early 1969. AMOCAR is owned by International Petroleum Colombia, Ltd. (INTERCOL), a subsidiary of Standard Oil Co. (New Jersey).

Renovation of the Barrancabermeja fertilizer plant of Fertilizantes Colombianos (FERTICOL), which was reactivated in 1967, after having been closed for 2 years, continued during 1968 under a management contract with Petroquímica del Atlántico. The plant's ammonium nitrate and urea units resumed production, but the latter was in service intermittently for several months, as a result of difficulties experienced in reaction, concentration, and prilling operations. As of yearend 1968, the plant's four units had a daily output capacity of 150 tons of nitric acid, 65 tons of ammonia, 130 tons of ammonium nitrate, and 50 tons of urea.

Gem Stones.—The Banco de la República announced its intention to relinquish the administration of the emerald mines at Muzo and Coscuez. An autonomous entity, National Emerald Enterprise, established

[2] Where necessary, values have been converted from pesos (p) to U.S. dollars at the rate of 16.32p = U.S.$1.

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by executive order in mid-1968 was named to assume the responsibility of operating these mines.

Salt.—The Manaure sea-water evaporation facilities and the Mamonal alkali plant, formerly operated by the Banco de la República along with its rock-salt-producing monopoly, were transferred to the administration of the Government's Instituto de Fomento Industrial (IFI). During the latter part of 1968, IFI initiated a program to expand the daily output capacity of the Mamonal alkali plant to 750 tons of sodium carbonate, 260 tons of caustic soda, 250 tons of refined salt, and 108 tons of sodium. The cost of this $480 million program is to be financed through loans from Swiss, Italian, and Mexican interests.

The world's fourth ferric chloride plant was inaugurated near the Zipaquirá salt mines in September 1968. This plant is owned jointly by Pennsalt de Colombia, a subsidiary of the Pennsalt Chemicals Corp. of Philadelphia, Pa. (50 percent), IFI (40 percent), and local private investors (10 percent). IFI constructed the plant with Italian equipment in 1965 but was unable to place it into production because of technical problems. Pennsalt then provided technical and financial assistance and imported additional new equipment from the United States. Initial output of the plant was 10 tons per day, but plans call for this to be expanded eventually to 20 tons per day. The chlorine used at the ferric chloride plant is waste material from an adjacent soda plant.

MINERAL FUELS

Coal and Coke.—Approximately two-thirds of the country's annual coal output continued to be produced from mines in the Departments of Cundinamarca and Boyacá. Previously unexplored coal formations on the Sabana de Bogotá were demarcated by the National Mineral Inventory, but there was no investigation of quality or thickness of seams. Acerías Paz del Rio, the country's principal producer and consumer of metallurgical coke, continued to be the only company operating a major coal washery.

Petroleum and Natural Gas.—Crude oil output declined 8 percent during 1968, the third consecutive year of falling production. The steady depletion of Colombia's older oilfields, along with the failure to develop new production, were responsible for the decrease. This trend will be reversed, when the Orito oilfield, in the Putumayo area of southern Colombia, goes into production in early 1969. This field is expected to provide up to 15 million barrels of new production during 1969.

Table 5.—Colombia: Salient statistics of the petroleum and natural gas industry

		1966	1967	1968
Crude oil:				
Production	thousand 42-gallon barrels	71,430	68,877	63,435
Delivered to refineries	do	35,232	39,043	45,244
Exported	do	35,575	r 31,148	18,448
Natural gas:				
Production	million cubic feet	98,096	99,920	94,887
Consumption [1]	do	r 35,922	37,721	41,537
Injected [2]	do	36,684	42,097	37,200
Flared	do	r 25,490	20,102	16,100
Natural gas liquids:				
Production	thousand 42-gallon barrels	2,079	2,914	4,300
Consumption [3]	do	837	1,614	NA
Delivered to refineries	do	815	897	NA
Exported, mixed with crude oil	do	214	224	NA
Refinery products:				
Refinery output [4]	do	r 38,054	r 42,886	50,229
Consumption [5]	do	27,291	28,580	30,728
Exported	do	6,295	r 8,223	10,680

r Revised. NA Not available.
[1] Includes shrinkage at natural gas processing plants.
[2] Includes small quantities used for gas-lift operations.
[3] Excludes the propane and butane output of refineries.
[4] Includes quantities used for refinery fuel.
[5] Excludes most oil company use.

Source: Centro de Información de la Industria Petrolera.

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Output of natural gas also decreased during 1968, but the rate of decline was only 5 percent. The bulk of the gas produced was from oilfields where, in a number of cases, gas/oil ratios have been rising steadily in conjunction with reservoir depletion. Production of natural gas liquids increased as a greater percentage of the natural gas produced was run to natural gas processing plants.

In contrast to declining output, proved reserves of crude oil increased by 20 percent to a reported total of 1,030 million barrels at yearend 1968. Proved reserves of natural gas, as of the same date, totaled 1,730 billion cubic feet, 15 percent more than at yearend 1967. These increases resulted from an upward revaluation of reserves in the Putumayo area fields.

The Ministerio de Minas y Petróleos granted 14 new petroleum concessions to private companies in 1968. All of these concession contracts were signed during the last 2 months of the year following a compromise concerning the wording of the new contracts. Most of the concession areas awarded in 1968 were located in the largely unexplored llanos of eastern Colombia.

Drilling activity was only slightly higher in 1968 than during the previous year, but the success ratio rose sharply. Data on drilling activity and results were as follows:

	1967	1968
Wells drilled:		
Exploration:		
Oil---number	1	5
Dry---do	13	12
Subtotal---do	14	17
Development:		
Oil---do	12	22
Gas---do	1	-------
Dry---do	11	1
Subtotal---do	24	23
Total---do	38	40
Footage drilled---feet	241,119	260,000

Source: Petróleo Interamericano, March 1968 and March 1969.

All of the successful exploratory wells drilled during 1968 probably are in the Putumayo area. Development drilling during the same year was concentrated in the Orito and other Putumayo area oilfields.

In October 1968, the Government-owned Empresa Colombiana de Petróleos (ECOPETROL) announced a new $180 million, 5-year plan for exploration in key areas, especially the llanos in the eastern part of the country. This plan called for the use of the latest exploratory techniques and hardware, including digital seismic equipment. Both local and foreign capital will be sought to finance the plan.

The first stage of a program to expand the water injection facilities at the La Cira-Infantes field of ECOPETROL was more than 6 months behind schedule at yearend 1968 and was not expected to be completed until mid-1969. Capacity of the field's water injection facilities was to be increased from an existing 75,000 barrels of water per day to 175,000 barrels daily upon completion of the program's first stage and to 265,000 barrels per day, when the second stage is completed, probably in 1970. A program to increase the capacity of the 100,000-barrel-per-day waterflood system at the Tibu field of Colombian Petroleum Co. (COLPET) by 10,000 barrels daily was probably completed before yearend 1968.

A 40,000-ton-per-year paraffin unit was completed at ECOPETROL's Barrancabermeja refinery in 1968. Texas Petroleum Co. (TEXPET), operator for the concessions it holds jointly with Colombian Gulf Oil Co. in the Putumayo area, began construction of a 1,000-barrel-per-day refinery in the Orito oilfield during the year. This small plant will supply all of the company's Putumayo area requirements for motor gasoline, jet fuel (for helicopters), and distillate fuel oil. Residual fuel oil produced will be used to surface roads in the oilfields. Surplus motor gasoline, kerosine, and distillate fuel oil will be sold locally.

In September 1968, the Ministerio de Minas y Petróleos granted authorization for the construction of a 3,000-barrel-per-day refinery at Neiva, that is to be a joint venture between Tennessee Colombia, S.A. (TENNECOL), and ECOPETROL with the former holding a 51-percent controlling interest. Crude oil for the refinery, which is scheduled for completion during 1970, will be obtained from TENNECOL's nearby Dina oilfield.

Several pipeline projects were completed during the year. The longest of these was ECOPETROL's 204-kilometer refined products line from Puerto Salgar to Cartago. ECOPETROL also completed a 51-kilometer, 10-inch products line from Albán to

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Bogotá. This 10,000-barrel-per-day pipeline parallels the Barrancabermeja-Bogotá products line southeastward from the latter's southernmost pumping station. During the latter part of the year, Antex Oil and Gas Co., Inc., completed a 110-kilometer, 50-million-cubic-foot-per-day natural gas pipeline from the El Difícil gasfield to Barranquilla. A natural gas pipeline from the Payoa oilfield of Colombia-Cities Service Petroleum Corp. (COLCITGO) to Barrancabermeja was also placed in service.

The most important pipeline under construction at yearend 1968 was the crude oil line from the Orito oilfield to the Pacific coast port of Tumaco. This line and the sea loading facilities at Tumaco were being built for Colombian Gulf Oil Co. and TEXPET, and will be operated by the latter after their completion during early 1969. The pipeline will be operated at an initial rate of 60,000 barrels daily, but its capacity will be from 100,000 to 150,000 barrels daily depending primarily on the pumping facilities installed. Plans are to eventually connect this pipeline with other Putumayo area oilfields by means of smaller lines branching from the Orito field. Tanker loading at the Tumaco terminal will be from a floating berth located 7.2 kilometers offshore in 90 feet of water.

Construction was in progress during 1968 on several petrochemical facilities in addition to those summarized under Fertilizer Materials. Work was nearing completion on a low-density polyethylene plant adjacent to ECOPETROL's Barrancabermeja refinery. This plant, which will be owned jointly by ECOPETROL and The Dow Chemical Co., is to have a capacity of 15,000 tons per year. Another petrochemical facility under construction adjacent to the Barrancabermeja refinery was ECOPETROL's plant for the production of aromatic hydrocarbons. This plant will have an annual capacity to produce 40,000 tons of benzene, 20,000 tons of which will be used in the manufacture of cyclohexane; 43,000 tons of mixed xylenes; and an undetermined quantity of toluene.

As a result of a petrochemical integration agreement signed by Colombia and Venezuela, construction was begun on a $29-million caprolactam plant at Barranquilla during the latter part of the year. ECOPETROL and Instituto Venezolano de Petroquímica (I.V.P.), a Venezuelan Government-owned company, will each have a 45-percent share in the venture, and a Netherlands company will have the remaining 10 percent. Principal feedstocks for this plant will be cyclohexane from ECOPETROL's Barrancabermeja aromatic hydrocarbons complex and ammonia from I.V.P.'s plant under construction in Venezuela. Planned capacity of the Barranquilla installation is 16,000 tons per year of caprolactam, a raw material used for the manufacture of nylon, and a byproduct output of 4.3 tons of ammonium sulfate per ton of caprolactam produced. Plans call for the installation of the necessary equipment to convert the ammonium sulfate into marketable fertilizer.

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Table 6.—Colombia: Distribution of landholdings, crude oil production, and refining capacity by companies, 1968

Company [1]	Principal ownership or affiliation	Nationality of ownership	Concessions as of Jan. 1, 1968 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1968 (thousand 42-gallon barrels daily)
Antex Oil and Gas Co., Inc.	Petroquímica del Atlántico and U.S. citizens.	Colombian/ United States.	(2)	380	-------
Chevron Petroleum Co. of Colombia.	Standard Oil Co. of California.	do	142,451	11,715	-------
Colombia-Cities Service Petroleum Corp (COLCITCO).	Cities Service Co	do	24,433	4,929	-------
Colombian Gulf Oil Co	Gulf Oil Corp	do	(3)	------	-------
Colombian Petroleum Co. (COLPET).	Mobil Oil Corp. and Texaco Inc.	do	311,456	7,720	4
Empresa Colombiana de Petróleos (ECOPETROL).	Colombian Government	Colombian	24,000	10,444	80
International Petroleum Colombia, Ltd. (INTERCOL).	Standard Oil Co. (New Jersey).	United States	254,292	------	49
Mecom, John W	John W. Mecom	do	44,859	------	-------
Phillips Petroleum Co	Phillips Petroleum Co	do	308,810	------	-------
Shell-Condor, S.A	Royal Dutch/Shell Group	British/Dutch	147,510	8,414	-------
Sinclair and BP Colombian, Inc.	Sinclair Oil Corp. and British Petroleum Co., Ltd.	United States/ British.	115,170	8,647	-------
Superior Oil International, Inc.	Superior Oil Co	United States	119,107	------	-------
Tennessee Colombia, S.A. (TENNECOL).	Colombian citizens	Colombian	82,606	297	-------
Texas Petroleum Co. (TEXPET).	Texaco Inc	United States	[3] 1,923,095	10,889	3
Total			3,497,789	63,435	136

[1] Companies appearing in this column are limited to those listed as concessionaires in official records and publications. Such official lists exclude firms which have obtained a participating interest from concession holders of record.

[2] Owns controlling interest in and is the operator for the Dina concession included in the area listed under International Petroleum Colombia, Ltd.

[3] Colombian Gulf Oil Co. holds a 50 percent interest in 1,464,685 hectares of the area listed under Texas Petroleum Co. The latter company is operator of the joint holdings.

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The Mineral Industry of the Democratic Republic of the Congo (Kinshasa)

By Eugene R. Slatick[1]

In 1968 the economic stability of the Congo (Kinshasa) continued to improve. Copper remained an important part of the country's economy by continuing to be the chief mineral produced and the major source of export earnings.

No settlement was made during the year by the Government for the mining properties it expropriated from Union Minière du Haut-Katanga (UMHK) in January 1967. UMHK values its assets at $800 million. Late in the year the World Bank offered to act as a mediator to settle the dispute. Reportedly, settlement of UMHK's claim would open the way for the Congolese Government to get large loans from the World Bank. According to some sources, the main problem in reaching settlement pertains to the form the compensation payments would take.

The Government acquired the 40 percent shares outstanding of La Générale Congolaise des Minerais (GECOMIN), which it formed to succeed UMHK. GECOMIN is now wholly owned by the Government. The action was the result of the Government's failure to attract foreign private companies to invest and actively participate in GECOMIN. Private companies can still participate in GECOMIN, either by acquiring shares from the Government or by subscription if the company increases its capitalization.

During the year the Government asked London-Rhodesian Mining and Land Co. Ltd. (Lonrho), a British company, to prepare a feasibility study for a railroad from the copperbelt to Matadi. A Japanese company has surveyed a route for the railroad. The cost to build such a railroad has been estimated at $150 million.

PRODUCTION

Production of most commodities rose in 1968. The production trends of copper and columbium-tantalum showed steady increases, whereas those of other mineral commodities fluctuated. Total diamond output declined because of a drop in the output of industrial diamond; in contrast, the output of gem diamond more than doubled. Petroleum refinery products began to be produced for the first time during the year.

[1] Foreign mineral specialist (petroleum), Division of International Activities.

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Table 1.—Congo (Kinshasa): Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Beryllium, beryl concentrate, gross weight	123	19	--	2	--
Cadmium, metal	469	399	421	263	320
Cobalt, metal	7,676	8,388	11,297	9,718	10,399
Columbium-tantalum concentrate	• 46	93	96	146	• 170
Copper, metal, blister and refined	276,640	288,605	315,664	318,976	320,628
Germanium, mine output, metal concentrate kilograms	8,271	14,638	14,970	347	--
Gold, metal troy ounces	188,693	90,408	159,821	153,520	169,975
Lead, metal, including secondary	1,045	1,551	1,060	• 1,000	--
Manganese, ore and concentrate, gross weight	309,700	377,575	249,303	271,636	321,811
Rare-earth minerals, monazite concentrate, gross weight	--	20	NA	NA	--
Silver, metal, secondary troy ounces	1,480,252	1,538,413	1,851,402	1,839,763	2,139,082
Tin:					
Mine output, metal content long tons	5,108	6,324	5,036	4,664	6,895
Metal, primary do	1,485	1,815	2,002	1,815	1,892
Tungsten, mine output, metal content	234	215	189	112	82
Zinc:					
Mine output, metal content	105,540	119,154	113,437	121,547	126,529
Metal, primary	55,553	57,019	• 61,500	61,492	62,573
NONMETALS					
Cement, hydraulic thousand tons	225	248	285	• 260	NA
Diamond:					
Gem thousand carats	295	14	12	263	551
Industrial do	14,457	12,490	12,418	12,891	11,353
Total do	14,752	12,504	12,430	13,154	11,904
Lime (quicklime and hydrated lime)	67,722	65,228	63,005	NA	NA
Salt, brine	525	125	80	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	106	116	110	133	71
Petroleum: Refinery products:					
Motor gasoline thousand 42-gallon barrels	--	--	--	--	691
Kerosine and jet fuel do	--	--	--	--	424
Distillate fuel oil do	--	--	--	--	1,006
Residual fuel oil do	--	--	--	--	1,595
Liquefied petroleum gas do	--	--	--	--	10
Total do	--	--	--	--	3,726

• Estimate. NA Not available.

TRADE

In 1967, mineral commodities continued to rank as the country's chief source of foreign exchange. That year the principal mineral exports and their respective values were copper, $201 million;[2] diamond, $25 million; cobalt, $21.1 million; tin, $20.5 million; and zinc, $18.7 million.

The major mineral commodities imported continued to be petroleum refinery products ($13 million) and iron and steel semimanufactures ($10.7 million). Imports of petroleum refinery products are expected to decline in 1968, because a petroleum refinery began operation during the year.

The values of mineral and total trade for reecnt years were as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	261.2	326.0
1966	379.6	467.3
1967	293.1	434.9
Imports:		
1965	47.2	319.9
1966	54.2	336.5
1967	31.3	256.1

[2] Where necessary, values have been converted from Zaires to U.S. dollars at the rate of Z1=US$2.

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Table 2.—Congo (Kinshasa): Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Cadmium, metal, including alloys, all forms	351	270	NA.
Cobalt, metal, including alloys, all forms	11,062	7,880	NA.
Columbium-tantalum, concentrate	56	61	United States 24; Switzerland 21; Belgium-Luxembourg 16.
Copper, metal, including alloys: Unwrought:			
Blister and other unrefined, unalloyed	79,475	e 76,000	NA.
Refined, unalloyed, mainly wire bars	156,364	152,755	Belgium-Luxembourg 40,870; Italy 32,770; France 32,612.
Cathode	74,785	65,216	Belgium-Luxembourg 25,998.
Total	310,624	e 293,971	
Gold, metal, unworked or partly worked. troy ounces	58,418	NA	
Iron and steel, metal, ferroalloys	-------	1,968	Japan 1,887.
Manganese, ore and concentrate	234,137	275,921	NA.
Tin:			
Ore and concentrate long tons	7,109	6,229	Belgium-Luxembourg 6,078.
Metal, including alloys, all forms do	1,873	1,299	All to Belgium-Luxembourg.
Tungsten, ore and concentrate	284	97	Belgium-Luxembourg: United States 24.
Zinc:			
Ore and concentrate	94,897	57,196	Republic of South Africa 29,992.
Metal, including alloys, all forms	50,970	78,544	Belgium-Luxembourg 12,891.
NONMETALS			
Cement	22,725	33,229	Zambia 19,401; Central African Republic 8,728.
Diamond, all grades thousand carats	12,480	e 13,100	United Kingdom e 11,392; United States 1,708.

e Estimate. NA Not available.

Table 3.—Congo (Kinshasa): Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	1,772	788
Copper, metal, including alloys, semimanufactures	170	57
Iron and steel, semimanufactures	66,238	50,759
Other:		
Ores, scrap, waste, n.e.s	286	320
Nonferrous metals, n.e.s	355	40
NONMETALS		
Cement	526	544
Fertilizer materials	6,030	5,974
Salt	50,408	27,941
Other:		
Building materials of asphalt, asbestos and fiber, cement and unfired nonmetals, n.e.s	42,886	1,517
Other nonmetallics, n.e.s	13,381	3
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	231,609	227,724
Petroleum: Refinery products:		
Gasoline, aviation thousand 42-gallon barrels	585	283
Gasoline, motor do	1,126	979
Kerosine and jet fuel do	581	492
Distillate fuel oil do	1,093	1,186
Residual fuel oil do	283	317
Lubricants do	r 115	61
Liquefied petroleum gas do	13	e 10
Other do	42	e 50
Total do	r 3,838	e 3,378
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	4,018	5,125

e Estimate. r Revised.

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COMMODITY REVIEW

METALS

Columbium-Tantalum.—Société Minière de Lueshe (SOMILU), a company owned by the Congolese Government and Union Carbide, was granted permission to exploit the large pyrochlore deposits at Lueshe and Bingo, in North Kivu Province. SOMILU plans to build a 40-ton-per-day pilot plant at Bingo to obtain preconcentrates containing 40 to 45 percent Cb_2O_5. A group of Japanese visited the Congo in 1968 to find new sources of columbium-tantalum, but no purchase agreements were reported.

Copper.—A new $17 million copper ore concentrator began operations in November at Kamoto, near Kolwezi. The plant, which has two autogenous grinding mills, can treat 1.8 million tons of ore and produce 60,000 tons of copper in concentrates per year. It raises the annual copper capacity of GECOMIN to about 385,000 tons.

Copper production in 1967 and 1968 was as follows, in metric tons:

Form	1967	1968
Ingots, electrolytic	160,822	153,080
Cathodes	81,448	70,513
Blister and other	76,706	97,035
Total	318,976	320,628

During the year a new company, Société de Developpement Industriel et Minier du Congo (SODEMICO), was formed to develop copper deposits recently found in Katanga. SODEMICO, which has an initial capital of $200,000, is owned by the Congolese Government (15 percent) and a Japanese consortium called Compagnie de Developpement Minier du Congo—CODEMICO—(85 percent); the Government has the right to acquire up to 50 percent of the company. CODEMICO, which is capitalized at $2.8 million, consists of the following Japanese companies: Nippon Mining Co., Ltd. (57 percent); Sumitomo Metal Mining Co., Ltd. (10 percent); Mitsui Mining and Smelting Co., Ltd. (10 percent); Toho Zinc Co., Ltd. (10 percent); Furukawa Mining Co., Ltd. (8 percent); and Nissho Co., Ltd. (5 percent).

Nippon Mining Co., Ltd., obtained prospecting rights in late 1967 to a total of 36,610 square kilometers in Musoshi and Kisenda districts in Southern Katanga Province, where the company has since found large copper deposits averaging about 2.1 percent copper. Reserves at Musoshi are estimated at 110 million tons; reserves averaging 3.3 percent copper have been reported at 30 million tons. Preliminary drilling at Kisenda have outlined reserves of at least 20 million tons.

Included in the development plans for the deposits is a smelter to produce about 50,000 tons of blister copper annually. The copper is to be transported about 2,000 kilometers by rail to Beira, Mozambique, for shipment to Japan. Full-scale operations are expected to begin in 1971.

A review of the country's copper mining industry was published during the year.[3]

Manganese.—Operations at the manganese mine of Société Minière de Kisenge (SMK) returned to normal during the early part of 1968, after being suspended in November 1967 because of an attack by mercenaries. The mine is at Kisenge, near the border with Angola. The company had to sell manganese at low prices during the year because of a continued depression of the world manganese market. Because of this, the future operation of the mine is uncertain.[4]

Tin.—Tin mining operations reportedly were nearing normality after being disrupted in 1967 by political disturbances. A new tin mining company, Congo Etain, was formed during the year by the Congolese Government and Compagnie Géologique et Minière des Ingénieurs et Industriels Belges (GÉOMINES). Congo Etain has a capital of about $10 million; the Government has a 50 percent share in the company. GÉOMINES, one of the Congo's largest tin mining companies, had been operating under the control of the Congolese Government since March 1967. It has mines in northern Katanga Province and an electric smelter at Manono.

[3] Everwyn, G. Congo Copper: A Review of the Mining Industry, Power, and Transportation Resources. Min. Mag., v. 118, No. 4, April 1968, pp. 254–261.

[4] Société Générale de Belgique. Annual Report. 1968, p. 67.

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During the period June 30, 1967-June 30, 1968, GÉOMINES produced 2,633 tons of cassiterite, compared with 2,755 tons during the previous period.[5] At mid-1968 the company employed 3,200 Congolese and 60 Europeans.

The geology and operations of the tin deposits of GÉOMINES and Syndicat Minière d'Etain (SYMETAIN), another large tin mining company, were described in reports[6] published during the year. SYMETAIN has mines in the western part of Kivu Province. Its reserves were estimated at more than 130,000 tons, most of which consists of detrital deposits.

Other tin mining companies include the Congolese subsidiaries of the Belgium-owned Compagnie Financière et Industrielle (CONFIMINES) and Société Belgo-Africaine du Kivu (SOBAKI). CONFIMINES' subsidiaries are MGL-Congo, Miluba-Congo, and Minerga-Congo; SOBAKI's are Kinorétain, Kivumines, and Phibraki.

In December 1968 the International Tin Council announced that the first quarter of 1969 would be another period of export control. The Congo's quota for the period was set at 1,764 tons, about 4.6 percent of world tin production.

NONMETALS

Diamond.—Production of industrial diamond by Société Minière de Bakwanga (MIBA) dropped from 13,152,602 carats in 1967 to 11,352,733 carats in 1968. This was due partly to the expiration of the company's contract to supply industrial diamond to the U.S. Government, which bought the diamond to aid the Congolese economy, and partly to the adverse effects that diamond smugglers and synthetic diamond had on the world diamond market. MIBA 3,800 employees are mostly Congolese. In September the Congolese Minister of Mines agreed in principle to grant MIBA's new prospecting and mining concessions under the terms of the mining code of 1967.[7] The company's operations are near Bakwanga, east of Luluabourg.

Illegal mining and smuggling of diamond continued during the year despite policing of the diamond fields. At least 4 million carats are believed to be smuggled out of the country annually, mainly to Congo (Brazzaville). Although illegal mining and smuggling occurs in MIBA's diamond fields, most of these activities are centered in the Tshikapa diamond fields, west of Luluabourg. The Tshikapa fields had been worked by Société Internationale Forestiere et Minière du Congo (FORMINIÈRE), but they reverted to the Government after the company was dissolved in 1966.

During the year the Government took measures to curb diamond smuggling. In October it allowed the Tshikapa fields to be worked by local diggers, and it had British Congo Diamond Distributors, Ltd. (BRITMOND) open a diamond-buying office at Tshikapa for a 3-month trial period. BRITMOND, which has the marketing rights to all diamond produced in the Congo, offered prices for diamond that were competitive with those offered by smuggling organizations.[8] It paid the Government a temporarily lowered export duty of 2.5 percent. Although this rate was less than the duty paid on the official production of MIBA, it did permit the Government to receive revenue from diamond that might have otherwise been smuggled out of the country. The Government plans to issue concessions in the Tshikapa diamond fields.

Late in the year, the Ministry of Lands, Mines and Energy announced that all Congolese holding illegal diamonds for artisinal purposes will be given a 3-month period of amnesty in which to sell them to special governmental purchasing offices. An office was scheduled to open in Kinshasa in January 1969; others are planned for the Kabinda and Sankuru districts of western Kasai Province. After the period, a special artisan permit will be required in order to possess, transport, or sell diamond.

MINERAL FUELS

Petroleum.—The Congo's first refinery, near the mouth of the Congo River at

[5] Compagnie Géologique et Minière des Ingénieurs et Industriels Belges. Annual Report for 1966–67 and 1967–68, p. 7.

[6] Anthoine, P., P. Evrard, C. Kharkevitch, and G. Schaar. The SYMETAIN Tin Deposits: Geology and Mining. Paper in a Technical Conference on Tin, London, 1967, sponsored by the International Tin Council. Wijland and Leiteritz, The Hague, Netherlands, v. 2, 1968, pp. 421–455.

The GEOMINES Company. The Work of GÉOMINES at Manono. Paper in Technical Conference on Tin, London, 1967, sponsored by the International Tin Council. Wijland and Leiteritz, The Hague, Netherlands, v. 2, 1968, pp. 501–508.

[7] Work cited in footnote 4.

[8] The Financial Times. No. 24,703, Nov. 22, 1968, p. 16.

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Banana, went on stream in February. It has a crude oil capacity of 13,800 barrels per day (b.p.d.); processing units include a 3,500 b.p.d. catalytic reformer and a 5,000 b.p.d. distillate hydrotreater.[9] The plant is owned by Société Congolaise Italienne de Raffinage (SOCIR), a joint venture comprised of the Congolese Government and Ente Nazionale Idrocarburi, Italy's state-owned petroleum company.

Crude oil throughput during the year averaged 11,310 b.p.d., about 82 percent of the plant's rated capacity. The pattern of refinery output differed from past import patterns for petroleum products mainly in that a high proportion of residual fuel oil was produced. Presumably, the excess will be offered for export.

Under a 5-year agreement signed during the year, the local petroleum marketing companies (Mobil Oil Corp., Petrofina S.A., Shell Oil Co., Texaco Inc.) will supply crude oil to the refinery and obtain refined products in proportion to their shares of the Congolese market. Imports of refined petroleum products are to be limited to those not produced at the refinery. The Government authorized an increase in the price of petroleum products.

No exploration has been reported since 1964, when Société Congolaise de Recherches et d'Exploitation Petrolières (SOCOREP) found a small amount of oil and gas in a coastal area well.

[9] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 128.

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The Mineral Industry of Cyprus

By Eugene R. Slatick [1]

The mineral resources of Cyprus continued to hold an important place in the country's economy in 1968. The mineral industry's contribution to the gross domestic product (GDP) was estimated to approximate its share in 1967, when it accounted for $27 million,[2] or 6.4 percent, of a GDP of $419 million.[3] In 1967, the mineral industry spent an estimated $21.4 million in Cyprus for wages, taxes, rents, royalties, supplies and equipment; payments to the Government totaled $743,000.[4] In 1968, an estimated 5,000 persons were employed in mining and quarrying operations; most worked above ground.

Mineral prospecting, mainly for copper and sulfur minerals, continued in 1968. At the beginning of the year, there were 76 prospecting permits covering 293 square kilometers, about the same as that a year previous.[5] The Geological Survey of Cyprus and the United Nations Special Fund, exploring together, found indications of new cuprous pyrite deposits north of the Troodos Mountains. The economic potential of the discoveries is to be determined. Most of the mining companies continued development and prospecting programs. Cytechno, Ltd., a recently formed Cyprus company, reportedly established the existence of new, economically exploitable reserves of asbestos and iron pyrites.

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[1] Foreign mineral specialist (petroleum), Division of International Activities.

[2] Where necessary, values have been converted from Cyprus pounds (C£) to U.S. dollars at the rate of C£1=US$2.80. In November 1967, the rate was changed to C£1=US$2.40; this change was not incorporated in the conversions in this chapter.

[3] Economic Report, 1967, Republic of Cyprus. Statistics and Research Department, Ministry of Finance, Nicosia, 1968, p. 2.

[4] Petropoulos, P. G. Annual Report of the Senior Mines Officer for the Year 1967. Nicosia, 1968, p. 3.

[5] Page 5 of work cited in footnote 4.

PRODUCTION

The pattern of mineral output in Cyprus in 1968 was generally similar to that in 1967. Output of both chromite and cement continued to increase at a rapid rate. Copper production rose, reversing the downward trend that began in 1966. Output of total gypsum dropped, but production of calcined gypsum rose sharply. Output of bentonite more than doubled.

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Table 1.—Cyprus: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Chromite	3,000	4,990	10,464	21,806	25,104
Copper [1]	13,000	20,450	17,757	15,507	17,086
NONMETALS					
Asbestos	12,478	15,986	22,180	17,642	17,242
Bentonite	1,553	3,048	2,947	4,531	10,160
Cement	70,000	98,357	98,560	186,708	241,344
Gypsum:					
Crude	45,000	60,975	45,061	45,700	20,320
Calcined	30,000	20,325	20,540	16,300	30,480
Lime	•40,000	73,550	•76,000	•82,000	•85,000
Mineral pigments:					
Terre verte	10	10	NA	17	7
Umber	•6,000	14,532	5,590	11,326	6,118
Yellow ocher	•400	304	102	463	650
Pyrites (sulfur content)—thousand tons	329	488	386	418	420
Salt	NA	5,355	4,013	6,687	4,816

• Estimate. NA Not available.

[1] Estimated content of concentrates, cement copper, and cuprous pyrite; excludes content in iron pyrites ore that may or may not be recovered.

TRADE

The trade balance of Cyprus in 1967 continued to be favorable in mineral commodities and unfavorable in total trade. Compared with 1966, the trade balance in minerals was less favorable, and minerals' share of total trade was reduced. The values of mineral trade and total trade for recent years follow:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities [1]	Total trade	
Exports:			
1966	34.2	77	44
1967	25.0	83	30
Imports:			
1966	21.4	158	14
1967	21.9	167	13
Trade balance:			
1966	+12.8	−81	XX
1967	+3.1	−84	XX

XX Not applicable.

[1] Values given are for only those commodities listed in tables 2 and 3 of this chapter.

By value, copper continued to be the most important mineral export, accounting for $14.9 million, or about 60 percent of the value of total mineral exports in 1967. Pyrite ranked second with a total of $6.9 million. Petroleum refinery products were again the chief mineral imports, being valued at $11.1 million. Dominating the petroleum category were fuel oils ($5.4 million) and motor gasoline ($3 million). Imports of iron and steel semimanufactures totaled $7.6 million.

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Table 2.—Cyprus: Exports of mineral commodities

(Metric tons)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Chromite	2,541	27,381	Mainland China 11,331; Austria 7,550; Canada 6,300.
Copper:			
Concentrate	58,682	45,341	Spain 16,790; West Germany 12,131; Japan 11,848.
Cement	14,778	8,914	West Germany 4,195; Japan 3,152; Spain 1,567.
Cuprous pyrite	164,248	186,621	West Germany 112,032; Netherlands 74,589.
NONMETALS			
Asbestos, crude	19,191	18,839	Denmark 5,034; United Kingdom 3,191; Thailand 2,770; Belgium 2,306.
Gypsum:			
Crude	56,543	13,162	Taiwan 10,262; Lebanon 2,900.
Calcined	1,215	298	Lebanon 251.
Mineral pigments:			
Ocher	319	463	United States 332; United Kingdom 67.
Terre verte	12	16	NA.
Umber:			
Crude	747	853	United States 545; United Kingdom 237.
Burnt	4,684	5,388	United States 3,537; United Kingdom 1,349.
Pyrite	746,819	721,660	Italy 331,732; Belgium 145,835; Netherlands 131,656.
Others	4,182	5,189	Israel 4,948.

NA Not available.

Table 3.—Cyprus: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum and alloys	406	424	Greece 191; Italy 67; United Kingdom 57.
Copper, including brass	89	51	Belgium 27; Netherlands 6; New Zealand 6.
Gold, troy ounces	15,706	16,084	United Kingdom 16,052.
Iron and steel:			
Pig iron	259	361	United Kingdom 244; U.S.S.R. 117.
Ferroalloys	5	5	All from United Kingdom.
Semimanufactures	50,369	59,151	France 17,648; Belgium 7,933; Italy 6,139; West Germany 5,993.
Lead and alloys	281	97	United Kingdom 85.
Tin and alloys, long tons	607	613	United Kingdom 606.
Zinc and alloys	64	211	Belgium 200.
NONMETALS			
Asbestos	r 102	165	United Kingdom 97; West Germany 43.
Cement	87,675	17,887	Greece 8,629; Israel 4,098; United Kingdom 1,999.
Clays	r 159	316	United Kingdom 149; Italy 100.
Fertilizer materials, manufactured:			
Nitrogenous	r 42,536	27,680	East Germany 7,479; United Kingdom 6,811; Italy 4,789; Portugal 3,773.
Phosphatic	26,160	20,233	Portugal 8,560; Yugoslavia 6,079; Lebanon 2,993.
Potassic	376	297	All from France.
Pumice	551	1	NA.
Salt	320	216	United Kingdom 201.
Stone, building:			
Unworked, value	$24,248	NA	
Worked, do	$9,456	NA	
Sulfur	2,028	-------	
MINERAL FUELS			
Asphalt and bitumen, natural	12,460	15,460	Spain 6,675; United Arab Republic 3,912; Israel 3,150.
Coal	522	177	All from West Germany.
Coke	350	209	All from West Germany.
Petroleum refinery products:			
Motor gasoline, thousand 42-gallon barrels	607	660	Italy 275; Netherlands Antilles 195.
Aviation gasoline, do	20	14	Netherlands Antilles 9; United Kingdom 5.
Kerosine, do	239	272	Italy 91; Netherlands Antilles 87; Greece 60.
Jet fuel, do	28	-------	
White spirits and solvents, do	3	3	United Kingdom 1; Netherlands Antilles 1.
Gas oil, do	642	743	Italy 378; Netherlands Antilles 154.
Fuel oil, including diesel, do	1,298	1,317	U.S.S.R. 888; Italy 296; France 91.
Lubricating oil and grease, do	32	36	United Kingdom 24; Netherlands 4.
Other, including pitch and wax, do	3	4	United Kingdom 3; West Germany 1.

r Revised. NA Not available.

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COMMODITY REVIEW

METALS

Chromite.—Chromite exports in 1967 were about 10 times higher than those in 1966 because of the continuation of high prices on the world market and the steady development program of Hellenic Mining Co. Ltd., which obtained the mines in 1964. The chromite mines are in the Troodos Mountains, and the treatment plant is at Ayios Nikolaos.

Copper.—During the year, Skouriotissa was the chief mine of Cyprus Mines Corp. The reserves at the Mavrovouni mine were nearing depletion. The planned output of ore in 1968 for Skouriotissa was about 600,000 tons, compared with about 75,000 tons for Mavrovouni.

The principal mine of Hellenic Mining Co. Ltd., in 1968 continued to be Kalavassos. Most of the mine's output was from the Mousoulos ore body. In 1967, development work at the mine totaled 580 feet of shafts and 6,335 feet of drifts.

In 1967, the Limni Mines of Cyprus Sulphur and Copper Co. Ltd., yielded 446,705 tons of ore, from which 19,476 tons of copper concentrate was obtained. Proven reserves totaled about 2 million tons averaging 1.1 percent copper. The continued exploitation of these low-grade reserves depends on the continuation of high prices for copper on the world market.

NONMETALS

Asbestos.—The Cyprus Asbestos Mines, Ltd., quarried 3.5 million tons of rock in 1967, up from 2.5 million tons in 1966. About 1.2 million tons were milled to produce 11,688 tons of long-grade fibers and 8,072 tons of short-grade fibers. In 1967 the Asbestos Cement Factory at Moni manufactured 31 tons of flat sheets, 874 tons of corrugated sheets, and 180 tons of molded goods.

Cement.—In 1968, cement was produced by the Cyprus Cement Co., Ltd., and Vassiliko Cement Works, Ltd.; the latter began production about 1967. The combined output of these plants is making Cyprus more self-sufficient in cement.

Fertilizer Materials.—Preparations were underway during the year to build a fertilizer plant costing an estimated $5 million near Larnaca. The owners of the plant will be Cyprus Cooperative Confederation (50 percent), the country's major importer and distributor of fertilizers, the Cyprus Orthodox Archbishopric, and Anastassis Leventis, a local businessman (25 percent each). Using the island's pyrite deposits and imported ammonia, the plant will have the capacity to produce 80,000 tons per year of superphosphate and ammonia-based fertilizers.

Gypsum.—United Gypsum, Ltd., continued to account for most of the gypsum produced. Limassol Chemical Products apparently continued to rank foremost among the several smaller producers.

MINERAL FUELS

During the latter part of 1968, Forest Oil Co. and Jack Grynberg and Associates, both U.S. companies, completed negotiations for an exploration venture with Industrija Nafte-Zagreb (INA), a Yugoslav State-owned petroleum company. Forest Cyprus Corp., Forest's subsidiary, obtained a license in Cyprus in late 1962 for 8,900 square kilometers and made extensive seismic surveys before its exploration was stopped by the civil disorder that erupted in 1963. Instead of resuming exploration after stability was restored, Forest farmed out the license to Grynberg, who arranged for the present agreement with INA. INA is to drill the first well (to about 9,000 feet) at its own expense. Thereafter, all future operating expenses of the new enterprise will be shared. The Cyprus Government is to receive 50 percent of the profits from any petroleum produced.

During the year, the Government was considering granting an oil exploration license to Cytex, a local company, for a small area near Limassol. In 1967, Terabyss, another Cyprian company, was granted a license covering a 1,140-square-kilometer area in the Paphos District.

Construction of the 10,000-barrel-per-day refinery planned for Larnaca by Cyprus Oil Refining Co., Ltd., had not yet begun at yearend 1968. The delay was due to the failure of the Government and the company to resolve several issues. There were reports that construction of the $17 million refinery was expected to begin in 1969.

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The Mineral Industry of Czechoslovakia

By Bernadette Michalski [1]

Coking coal and nonmetallics remained the principal minerals produced in Czechoslovakia. The abundant fuel and refractory clay resources have supported significant metallurgical and fabricating industries. Although the nation is almost totally dependent upon iron ore imports, it ranked about 10th among world producers of steel and expansion and development programs were under way to assure Czechoslovakia a continued position as a significant world steel producer.

PRODUCTION

Production figures for many commodities were unavailable for 1968. While the year's unrest may have resulted in reduced output of several commodities, Czechoslovakia reported an overall industrial production growth rate of 5.2 percent in 1968 compared with the 7.5 percent average growth for 1965–67.

[1] Foreign mineral specialist, Division of International Activities.

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Table 1.—Czechoslovakia: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum, metal, including secondary thousand tons	60	62	62	65	65
Antimony:					
Mine output, metal content •	1,200	1,200	1,200	1,100	1,100
Metal •	2,000	2,300	2,500	NA	NA
Copper, mine output, metal content • r	8,000	10,000	10,000	10,000	10,000
Iron and steel:					
Iron ore—thousand tons	2,846	2,446	r 2,226	1,914	1,540
Pig iron (including blast furnace ferroalloys) thousand tons	5,716	5,868	6,269	6,822	NA
Ferroalloys, electric furnace—do	55	57	91	97	NA
Steel ingots and castings—do	8,377	r 8,599	9,128	10,002	NA
Steel semimanufactures—do	6,465	7,000	7,494	8,103	NA
Lead:					
Mine output, metal content • r	14,000	15,000	15,000	15,000	15,000
Metal, including secondary • r	15,000	20,000	20,000	20,000	20,000
Manganese, ore, gross weight	84,000	80,000	90,000	80,000	------
Mercury, metal •—76-pound flasks	775	825	875	900	900
Nickel, metal, primary •	NA	500	500	800	800
Silver •—thousand troy ounces	2,400	2,400	2,400	2,400	------
Tin, mine output, metal content—long tons	NA	NA	148	150	• 155
NONMETALS					
Barite •	5,000	5,000	5,000	5,000	5,000
Cement, hydraulic—thousand tons	5,493	5,713	6,130	6,460	NA
Clays, kaolin (including china clay)—do	313	r 322	r 325	335	• 300
Fertilizer materials: Manufactured:					
Nitrogenous, N content—do	158	220	251	245	NA
Phosphatic:					
Thomas slag, P_2O_5 content	24,196	24,515	22,275	16,512	NA
Other, P_2O_5 content	216,514	233,412	238,771	257,685	NA
Gypsum and anhydrite:					
Crude—thousand tons	351	331	356	371	NA
Calcined—do	23	r 23	r 21	22	NA
Lime (quicklime and hydrated lime)—do	2,347	r 2,405	r 2,374	2,362	NA
Magnesite:					
Crude—do	1,686	1,841	1,901	2,106	NA
Clinker—do	453	479	493	517	NA
Pyrite:					
Gross weight—do	361	375	352	376	NA
Sulfur content •—do	155	146	137	160	NA
Salt—do	184	191	197	202	NA
Stone, sand and gravel, n.e.s.:					
Dimension stone: Limestone and other calcareous—thousand tons	14,635	15,158	15,736	16,255	NA
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen	397,783	407,307	528,872	611,033	NA
Coal:					
Bituminous—thousand tons	r 28,201	r 27,624	r 26,731	25,946	25,800
Lignite and brown—do	75,605	73,216	74,108	71,362	• 70,000
Coke:					
Bituminous coal—do	9,421	9,496	9,465	9,307	NA
Brown coal—do	1,929	1,693	1,773	1,812	NA
Fuel briquets: Brown coal—do	784	791	795	912	NA
Gas, manufactured, all types—million cubic feet	197,443	204,859	208,744	214,677	NA
Petroleum:					
Crude oil—thousand tons	195	192	190	200	NA
Refinery products:					
Kerosine—do	110	137	134	216	NA
Diesel oil—do	1,779	2,072	2,242	2,460	NA
Lubricants—do	93	115	123	124	NA

• Estimate. r Revised. NA Not available.

TRADE

Czechoslovakia's mineral trade remained closely tied to that of the Communist Economy (Comecon) countries. However, trade with countries other than the Comecon are expected to increase both as a result of the implementation of the Iranian-Czechoslovak petroleum agreement for 1969–74 and anticipated iron ore imports from India and Sweden. The value of overall mineral trade of Czechoslovakia with the Organization for Economic Cooperation and Development (OECD) in 1966, was U.S. $285 million.

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Table 2.—Czechoslovakia: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys:			
Scrap [2]	2,020	NA	
Unwrought [2]	3,164	NA	
Copper:			
Ore and concentrate [2]	5,762	NA	
Metal, including alloys:			
Scrap [2]	1,512	NA	
Unwrought [2]	3,300	NA	
Iron and steel: Metal:			
Scrap [2]	37,000	NA	
Pig iron, ferroalloys and similar materials [2]	194,000	NA	
Steel, primary forms [2]	27,600	NA	
Steel semimanufactures, thousand tons	1,890	1,990	Yugoslavia 237; Poland 166; U.S.S.R. 155; Hungary 134; West Germany 120.
NONMETALS			
Cement [2]	171,035	NA	
Clays, kaolin, thousand tons	165	165	Poland 46; West Germany 30; East Germany 15.
Graphite, natural [2]	997	NA	
Magnesite, thousand tons	207	217	West Germany 70; Poland 57; Hungary 46.
Stone, sand, and gravel [2]	73,500	NA	
MINERAL FUELS AND RELATED MATERIALS			
Coal:			
Bituminous, thousand tons	2,077	2,327	East Germany 871; Hungary 568; Rumania 360.
Lignite, do	1,142	1,138	West Germany 1,108.
Coke and semicoke, do	2,397	2,167	East Germany 662; Rumania 369; Austria 300; Hungary 283.
Petroleum: Refinery products:			
Gasoline [2]	80,964	NA	
Distillate fuel oil [2]	349,538	NA	
Residual fuel oil [2]	222,849	NA	
Lubricants [2]	13,948	NA	

[1] Because Czechoslovakia publishes only limited data on foreign trade in minerals, this table has been compiled from several sources. U.S.S.R. official trade statistics report approximately US$100 million in ores and metals received from Czechoslovakia in both 1966 and in 1967, which probably includes steel primary products and semimanufactures as well as nonferrous ores and metals. Except as noted, information is from Statisticka Rocenka Ceskoslovenske Socialisticke Republiky, 1968, (Statistical Annual of the Czechosovak Socialist Republic), Prague, 607 pp.

[2] Statistical Office of the United Nations. 1967 Supplement to the World Trade Annual, Vol. 1, East Europe. Walker and Co., New York, 1969, 360 pp.

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Table 3.—Czechoslovakia: Imports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate[2 3]	295,974	326,375	Hungary 251,000.
Oxide and hydroxide[2]	10,000	10,000	All from Hungary.
Metal, including alloys:			
Unwrought[2 4]	21,362	31,004	U.S.S.R. 28,900.
Semimanufactures[4]	8,332	12,283	All from the U.S.S.R.
Cadmium, metal, including alloys, all forms[4]	205	141	Mainly from the U.S.S.R.
Chromite[4] thousand tons	49	45	All from the U.S.S.R.
Copper, metal, including alloys:			
Unwrought[4]	27,400	28,400	All from the U.S.S.R.
Semimanufactures[4]	601	592	All from the U.S.S.R.
Iron and steel:			
Ore and concentrate thousand tons	9,336	10,366	U.S.S.R. 8,690; India 942.
Pig iron, ferroalloys and selected material. do	153	250	U.S.S.R. 146.
Steel semimanufactures[4] do	343	376	All from the U.S.S.R.
Lead, metal, including alloys: Unwrought[4 5]	21,000	25,500	U.S.S.R. 24,200.
Manganese:			
Ore and concentrate thousand tons	287	306	U.S.S.R. 185; India 86.
Oxides[4]	1,000	900	All from the U.S.S.R.
Mercury[5] 76-pound flasks	3,249	NA	
Nickel, metal, including alloys, all forms[4]	2,400	NA	
Tin, metal, including alloys, all forms.[5] long tons	340	NA	
Zinc, metal, including alloys, all forms[4 5]	28,100	32,800	U.S.S.R. 16,600; Poland 10,200.
NONMETALS			
Asbestos	32,996	33,060	U.S.S.R. 20,486, Canada 4,957; Austria 4,176.
Cement[4]	60,000	94,000	Poland 72,000; U.S.S.R. 22,000.
Fertilizer materials:			
Crude: Phosphatic[4] thousand tons	483	481	All from the U.S.S.R.
Manufactured:			
Nitrogenous, N content do	41	53	East Germany 15; Austria 13.
Phosphatic, P_2O_5 content do	270	297	U.S.S.R. 184; Lebanon 19.
Potassic, K_2O equivalent do	486	466	East Germany 428.
Graphite, natural[4]	105	195	All from U.S.S.R.
Magnesite[5]	1,500	---	
Pyrite, gross weight thousand tons	125	95	U.S.S.R. 30; Yugoslavia 11.
Sulfur:			
Elemental, all forms do	238	237	Poland 120; U.S.S.R. 37.
Sulfuric acid[4] do	15	30	All from the U.S.S.R.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	77,535	49,328	All from Hungary.
Carbon black[4 5]	4,800	5,300	Mainly from the U.S.S.R.
Coal, anthracite and bituminous thousand tons	4,080	4,162	U.S.S.R. 2,342; Poland 1,820.
Coke and semicoke[4] do	5	91	Mainly from the U.S.S.R.
Gas, hydrocarbon: Natural[4] million cubic feet	0	9,365	All from the U.S.S.R.
Petroleum:			
Crude[4] thousand tons	6,396	7,425	All from the U.S.S.R.
Refinery products:			
Gasoline[4] do	227	186	All from the U.S.S.R.
Kerosine[4 5] do	255	260	Mainly from the U.S.S.R.
Diesel oil[4] do	18	84	All from the U.S.S.R.
Other[4 5] do	35	50	Mainly from the U.S.S.R.

NA Not avialable.

[1] Because Czechoslovakia publishes only limited data on foreign trade in minerals, this table has been compiled from several sources. Except as noted, information is from Statisticka Rocenka Ceskoslovenske Socialisticke Republiky, 1968, (Statistical Annual of the Czechoslovak Socialist Republic), Prague, 607 pp.

[2] Statisticheskiy Yezhegodnik 1967 (Statistical Yearbook), Hungarian Statistical Office, Budapest, 1968, 320 pp.

[3] Statistika Spoljne Trgovine SFR Jugoslavije, 1967, (Statistics of Foreign Trade of the SFR Yugoslavia, 1967), Belgrad, 1968, 550 pp.

[4] Ministerstvo Vneshney Torgovli U.S.S.R. (Ministry of Foreign Trade of U.S.S.R.) Vneshnyaya Torgovlya S.S.S.R. za 1967 God (Foreign Trade of the U.S.S.R. for 1967), Moscow, 1968, 395 pp.

[5] Statistical Office of the United Nations. 1967 Supplement to the World Trade Annual. V. 1, East Europe. Walker and Co., New York, 1969, 360 pp.

COMMODITY REVIEW

METALS

Antimony.—An antimony deposit newly discovered at Struzec in central Slovakia is scheduled to be mined by open pit early in 1969. While grade of ore and mine capacity are not given, the Czechoslovak source claims that the new mine output will

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be sufficient to replace imported ores and concentrates. Turkish trade data showed exports of 2,200 tons of antimony ore to Czechoslovakia in 1966 and 1,227 in 1967. Mainland China may have also supplied Czechoslovakia some ore. In addition to domestic and imported ores and concentrates, some antimony may be recovered as a byproduct of lead smelting. Total metal output exceeds consumption requirements allowing an exportable surplus. West Germany is probably the largest market for Czechoslovak antimony metal. Germany imported 646 tons of antimony in 1966 and 277 tons in 1967 from Czechoslovakia.

Iron and Steel.—A new iron mine was opened at Medenes in northern Bohemia. Ore from the mine (probably 24 to 29 percent Fe content) was to be shipped to the Klement Gottewald Works at Ostrava.

The Vitkovice Iron and Steel plant at Ostrava, Czechoslovakia's largest steel works, underwent an expansion and rationalization program in 1968. Parts of the program included the replacement of three of its six blast furnaces, each with 400-cubic-meter volume, by a new 1,719-cubic-meter furnace.

An electrolytic tinning plant of 160,000-ton annual capacity was completed in 1968 at the East Slovakian Iron and Steel Works at Kosice, Czechoslovakia's newest steel complex. Production from other units of the Kosice plant were estimated as follows in million metric tons for 1968: Steel ingots 1.5; pig iron 1.3; steel sheets 1.2.

Mercury.—Czechoslovakia produces mercury as a byproduct of iron ore, copper ore, and pyrite operations. However, domestic output estimated at 900 flasks supplies only a fraction of consumption requirements. Spain exported 2,927 flasks of mercury to Czechoslovakia in 1966, 2,852 flasks in 1967, and an estimated 4,000 flasks in 1968. In an effort to fully utilize domestic resources the Czechs began constructing a mercury refinery at Rudnany; completion is scheduled for mid-1969. The plant capacity is estimated at 1,000 flasks and will probably process the complex ores of the Spisska Nova Ves deposit.

NONMETALS

Bentonite.—A bentonite processing plant of 100,000-ton annual capacity was commissioned at yearend. The plant, located near Zelenice, is part of the Severoceske Keromicke Zavody (North Bohemian Ceramic Complex).

Table 4.—Salient statistics on iron and steel production

		1965	1966	1967
PIG IRON				
Number of blast furnaces		23	22	20
Production of pig iron and ferroalloys:				
Pig iron for steel making	thousand metric tons	5,129	5,559	6,255
Pig iron for foundry	do.	646	661	521
Blast furnace ferroalloys	do.	93	49	46
Total	do.	5,868	6,269	6,822
Materials consumed per ton of pig iron:				
Iron ore and manganese ore	kilograms	561	504	428
Sinter	do.	1,289	1,329	1,444
Scrap	do.	69	52	44
Coke	do.	739	684	651
Limestone	do.	285	220	178
INGOT STEEL				
Number of open hearth furnaces		[1] 73	NA	NA
Production of crude steel:				
Open hearth	thousand metric tons	7,201	7,402	7,441
Bessemer	do.	237	242	247
Electric furnace	do.	1,161	1,209	1,254
Oxygen convertor	do.	--	275	1,060
Total	do.	8,599	9,128	10,002
Materials consumed per ton of crude steel:				
Pig iron	kilograms	595	599	623
Scrap	do.	474	479	472

NA Not available.
[1] Six 400-ton capacity; six 200- to 400-ton capacity; fifteen 100- to 200-ton capacity and remainder under 100-ton capacity.

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Fluorspar.—Czechoslovakia's growing steel and chemical industry consumes about 100,000 tons of fluorspar annually. About half of this requirement was satisfied by several small mines in northern Bohemia producing metallurgical fluorspar concentrated by gravity separation. A new acid grade fluorspar flotation plant was under construction at Sobedruky with completion scheduled for 1969. When the plant is in full operation, fluorspar imports will reportedly discontinue.

Kaolin.—Construction of the Bozicany kaolin flotation plant was slated during the year. This plant is scheduled to start production in 1972 and attain full capacity in 1974.

MINERAL FUELS

During 1968 approximately 7.5 million tons of crude oil were supplied to Czechoslovakian refineries by the Soviet Union via the Friendship pipeline; however, by 1970 part of Czechoslovakia's crude petroleum supply may be drawn from the Middle East. A 5-year trade agreement between Czechoslovakia and Iran, signed in 1968, offers Czechoslovakian industrial equipment in exchange for Iranian crude oil.

Deliveries of natural gas from the Soviet Union will be facilitated by a second pipeline. The construction on the 300-mile long Kiev pipeline will begin in 1969 using pipes manufactured in Czechoslovakia. By 1970, 46 million cubic feet will be imported from the Soviet Union increasing to more than a 100 million cubic feet by 1975.

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The Mineral Industry of Finland

By F. L. Klinger[1]

A high level of activity was maintained in most branches of the Finnish mineral industry in 1968, despite early uncertainties resulting from devaluation of the markka in late 1967 and the persistence of strong inflationary trends in the nation's economy. In March, sweeping controls were established over wages, prices, rent, interest, and even taxes. These measures, which are scheduled to remain in force through 1969, were effective in stabilizing the economy, and with the added incentive of strong foreign demand, production and exports of many commodities matched or exceeded the levels of 1967. The construction industry was relatively depressed; however, building activity was increasing by year-end and a recovery was possible in 1969.

There were several significant individual developments in 1968. In mineral supply, the Luikonlahti copper mine was brought into production and another was under development near Outokumpu; deposits of talc were being developed near Kotkamo, to partially replace imported kaolin for the large paper industry; and additional deposits of apatite, discovered in Lapland, increased the known reserves of phosphate and associated rare-earth metals. In mineral processing, Finland became the only West European country to produce significant quantities of cobalt and ferrochromium from domestically mined ores; initial contracts were let for construction of the country's first zinc smelter; and the flash-smelting process developed by Outokumpu Oy. was adopted by several more foreign companies. In addition, an important expansion of rolling facilities was begun at the Raahe steelworks; crude oil refining capacity was doubled at Porvoo; and plans for construction of an atomic powerplant at Loviisa were temporarily abandoned.

[1] Physical scientist, Division of International Activities.

PRODUCTION

Production indices of major sectors of the mineral industry were as follows:

	(1959 =100)		
Industry sector	1966	1967	1968 [1]
Mines and quarries [2]	133	140	137
Primary metal plants [2]	217	220	251
Nonmetallic mineral product plants [2]	219	224	223
Petroleum refineries [3]	348	436	561
All industry [2]	167	171	176

[1] Average of monthly indices for 10 months (January–October).
[2] Source: Central Bureau of Statistics (Helsinki). Bulletin of Statistics (Tilastokatsauksia), No. 12, December 1968.
[3] Estimate based on annual refinery throughout reported by Neste Oy.

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Table 1.—Finland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Chromite concentrate, gross weight	-------	-------	NA	6,384	36,196
Cobalt:					
Mine output, metal content	[1] 1,684	[1] 1,493	[1] 1,438	• 1,800	• 1,700
Metal	-------	-------	--------	17	505
Copper:					
Mine output, metal content	r 32,557	r 30,160	r 26,723	29,336	• 29,800
Metal, electrolytic	33,177	30,522	31,912	r 34,173	35,895
Gold, metal—troy ounces	r 22,049	r 18,027	r 15,471	20,281	21,380
Iron and steel:					
Iron ore and concentrate:					
Magnetite concentrate	r 477,000	658,000	r 638,000	642,000	• 510,000
Pelletized iron oxide (from pyrite)	204,000	227,000	324,000	299,000	341,000
Roasted pyrite (purple ore)	NA	NA	NA	39,421	100,720
Pig iron	592,000	934,000	934,000	r 1,017,000	1,039,000
Ferrochromium	-------	-------	-------	---------	7,830
Steel, crude	371,000	363,000	399,000	411,000	700,000
Steel semimanufactures	328,000	351,000	366,000	340,000	554,000
Lead, mine output, metal content	1,890	r 6,308	4,633	4,786	4,524
Nickel:					
Mine output, metal content	r 3,204	r 2,989	2,952	r 3,458	3,326
Metal, electrolytic	2,943	2,776	2,993	3,003	3,327
Sulfate, metal content •	147	163	185	160	177
Rare-earth metals:					
Lanthanide concentrates, gross weight	-------	-------	2,610	14,127	12,152
Mine output, oxide content •	-------	-------	70	500	402
Oxides	NA	NA	43	NA	NA
Selenium, metal—kilograms	6,577	5,705	5,431	6,696	7,296
Silver, metal—troy ounces	608,000	582,000	520,000	623,000	677,000
Titanium, ilmenite concentrate, gross weight	116,063	106,825	117,560	126,900	140,000
Vanadium:					
Mine output, metal content •	1,350	1,287	1,230	1,470	1,477
Pentoxide:					
Gross weight	1,756	1,721	1,733	2,093	2,139
Metal content	983	964	970	1,172	1,198
Zinc, mine output, metal content •	63,000	69,000	54,400	60,800	65,400
NONMETALS					
Asbestos	10,533	12,072	12,020	10,524	13,140
Cement, hydraulic—thousand tons	1,572	1,770	r 1,575	1,514	• 1,480
Diatomite	2,170	950	1,200	1,619	1,980
Feldspar	14,900	11,872	26,317	35,025	• 50,000
Fertilizer materials, manufactured:					
Ammonia, primary, nitrogen content	• 61,000	72,000	77,000	83,000	NA
Phosphoric acid, P_2O_5 content	-------	-------	22,000	39,000	NA
Superphosphate, gross weight	514,300	437,400	r 571,300	395,100	• 320,000
Lime	240,000	245,000	227,000	230,000	210,000
Pyrite and pyrrhotite (including cupreous): [2]					
Gross weight	551,223	585,430	516,477	711,629	774,000
Sulfur content	264,000	288,700	249,200	341,000	371,000
Quartz	28,500	35,312	43,670	61,000	42,000
Stone, n.e.s.:					
Dimension stone (marble)	800	200	NA	---------	NA
Other, including limestone—thousand tons	3,500	3,800	3,553	3,700	• 3,600
Sulfur, byproduct (recovered):					
Elemental	68,139	73,771	73,641	101,413	125,249
Gaseous (in SO_2)	• 119,900	• 126,200	159,396	181,891	205,088
Talc and soapstone:					
Talc	6,000	7,000	5,000	2,562	• 6,000
Soapstone—cubic meters	150	• 125	125	150	• 200
Wollastonite	3,000	2,393	3,813	• 3,500	4,296
MINERAL FUELS AND RELATED MATERIALS					
Coke, all types	145,000	142,000	153,000	136,000	NA
Fuel briquets	17,000	28,000	25,000	25,500	26,000
Gas, manufactured—thousand cubic meters	68,411	70,103	r 74,890	72,492	• 60,000
Peat, for fuel use	r 110,000	r 100,000	• r 100,000	• 100,000	• 100,000
Petroleum refinery products:					
Gasoline—thousand tons	553	700	762	941	1,082
Kerosine and jet fuel—do	[3] 13	33	45	42	66
Distillate fuel oil—do	421	1,640	2,658	3,113	3,742
Residual fuel oil—do	1,048				
Liquefied petroleum gases—do	34	42	52	56	52
Lubricants—do	NA	NA	NA	74	---------
Other, including bitumen—do	292	211	189	221	221
Total refinery products—do	2,361	2,626	3,706	4,447	5,163
Total crude oil processed—do	2,554	2,772	3,714	4,657	5,990

• Estimate. r Revised. NA Not available.

[1] Source: United Nations (1964–66).

[2] Excluding pyrrhotite from Kotalahti mine.

[3] Kerosine only.

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The slight decline in the index for mines and quarries was mostly due to reduced output of iron ore, which resulted from closing of the Jussarö mine in 1967 and the Kärväsvaara mine in 1968, and partly due to reduced output of construction materials. Actually, production at most of the country's mines increased with gains of about 25 percent at Vihanti, 10 percent at Pyhäsalmi, and a severalfold increase in output of chromite from the new mine near Kemi. Record quantities of cobalt, pelletized iron oxide, and sulfur were recovered from pyrite at Kokkola, and ferrochromium production was started at Tornio.

The rise in index for primary metals resulted largely from increased production of steel at Raahe, where the new plate mill was operated for the first full year. The continued rise of the index for petroleum refineries was due to increasing production from the Porvoo refinery, which reportedly became the largest in Scandinavia at the end of October.

TRADE

The 1967 currency devaluation, together with the stabilization measures introduced in 1968, helped to shift Finland's balance of trade into the surplus column for the first time since 1958. The dollar value of exports exceeded that of imports by approximately $44 million, as compared with a deficit of $176 million in 1967.

In mineral commodity trade, the deficit remained close to $300 million but it was reduced by $22 million compared with that of the previous year. The improvement was principally due to increased domestic production of steel at Raahe, which led to a reduction of 100,000 tons in imports of steelplate. The gain in steel trade was partially offset by increased imports of crude oil.

The value of total trade and mineral commodity trade for the last 3 years is shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total trade
Exports:		
1966 r	123	1,505
1967	123	1,635
1968	121	1,686
Imports:		
1966	r 404	1,726
1967	429	1,811
1968	405	1,592

Metals and metallic ores continued to be the principal items in mineral commodity trade in 1968, accounting for 80 percent of the value of exports and nearly 40 percent of the value of imports. The share of fuels in the value of imports rose to 51 percent in 1968, as compared with 39 percent in 1965.

The values of major items in Finland's mineral commodity trade in 1967 and 1968 are tabulated as follows:

	Value (million dollars)[1]	
	1967	1968
EXPORTS		
Iron and steel [2]	45.6	44.5
Copper	30.5	29.2
Zinc ore	8.3	7.4
Titanium [3]	2.3	1.9
Nickel	7.4	8.7
Vanadium	5.2	4.0
IMPORTS		
Iron and steel [2]	133.6	113.5
Aluminum	21.0	18.1
Copper	14.2	15.2
Lead and zinc	4.9	4.3
Fertilizer materials	18.6	18.4
Crude petroleum	79.7	86.9
Solid fuels	36.7	32.3
Petroleum products	86.7	86.5

[1] Converted from values in Finnmarks as follows: 1967, Fmk. 3.2 =$1; 1968, Fmk. 4.2 =$1.
[2] Includes iron ore and scrap.
[3] Includes ilmenite and titania.
Source: Official Statistics of Finland (Helsinki). Ulkomaankauppa (Foreign Trade). December 1968.

In mineral commodities, Sweden remained the principal buyer of Finnish exports, accounting for approximately 25 percent of the total value, followed by West Germany and the United Kingdom with 17 percent each. These countries also supplied about one-third of Finland's imports, in terms of value. The Soviet Union continued to supply most of Finland's fuel, and the Soviet share of the value of Finland's mineral commodity imports rose to nearly 50 percent in 1968. In contrast, less than 2 percent of the value of Finnish exports was destined for the U.S.S.R.

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Table 2.—Finland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum metal, including alloys, all forms	2,205	2,648
Copper:		
Matte	---	215
Metal, including alloys:		
Unwrought	13,444	11,922
Semimanufactures	11,263	12,200
Iron and steel:		
Ore and concentrate, except roasted pyrite	142,163	121,501
Roasted pyrite	70,008	5,619
Metal:		
Scrap	3,608	4,906
Pig iron, including cast iron	783,798	791,918
Steel, primary forms	12,514	2,448
Semimanufactures	21,382	57,300
Lead ore and concentrate	10,449	7,545
Nickel metal, including alloys:		
Unwrought	2,626	2,648
Semimanufactures	190	21
Platinum-group metals and silver: Metal, including alloys value, thousands	$461	$843
Selenium, elemental	5	5
Tin metal, including alloys, all forms long tons	70	11
Titanium:		
Ore and concentrate	50,665	40,431
Dioxide	21,448	5,128
Vanadium oxides	2,130	2,491
Zinc:		
Ore and concentrate	112,542	115,327
Metal scrap	---	134
Other:		
Ashes and residues containing nonferrous metals	8,834	1,222
Oxides, hydroxides, and peroxides of metals, n.e.s	5,167	1,993
Metals, including alloys, all forms:		
Alkali and rare earth metals	9	53
Base metals, n.e.s	31	169
NONMETALS		
Asbestos	8,528	8,849
Cement	27,738	12,803
Clay products value, thousands	$268	$307
Diatomite and other infusorial earths	137	98
Feldspar	20,896	31,135
Fertilizer materials, manufactured	100,276	16,864
Lime	502	1,505
Mica, all forms	25	25
Precious and semi-precious stones, except diamond value, thousands	$18	$21
Pyrite	51,230	31,311
Stone, sand and gravel:		
Dimension stone	7,830	9,887
Limestone (except dimension)	4,357	6,465
Sand, gravel, and other crushed rock	480	
Quartz and quartzite	1,214	NA
Sulfur:		
Elemental, all forms	1,230	7,710
Sulfuric acid	---	15,828
Other nonmetals, n.e.s.:		
Slag, dross and similar waste, not metal bearing	10,050	NA
Other	---	67
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	10,467	13,203
Coke and semicoke	8,913	6,710
Gas, hydrocarbon	1,614	9,502
Peat and peat briquets	347	502
Petroleum refinery products:		
Gasoline	•19,647	•171,804
Kerosine	---	---
Distillate fuel oil	9	24,953
Residual fuel oil	---	104,708
Lubricants	75	94
Other	177	NA

• Estimate. r Revised. NA Not available.

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Table 3.—Finland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Ore and concentrate	35	7,786	France 3,358; Greece 3,300.
Oxide and hydroxide	13,740	16,726	West Germany 6,648; Hungary 5,365.
Metal, including alloys, all forms:			
Unwrought	11,977	14,461	U.S.S.R. 8,512; Norway 2,682.
Semimanufactures	13,922	13,782	U.S.S.R. 5,523; Sweden 5,323.
Antimony metal	67	50	China (mainland) 35.
Arsenic trioxide, pentoxide, and acids	447	422	Sweden 417.
Chromium:			
Chromite	76	455	Republic of South Africa 435.
Oxide and hydroxide	583	319	West Germany 205.
Cobalt:			
Oxide and hydroxide	4	3	Mainly from United Kingdom.
Metal, including alloys, all forms	NA	NA	
Copper metal, including alloys:			
Scrap	302	2	NA.
Unwrought	11,446	6,628	Zambia 2,499; Chile 2,182.
Semimanufactures	4,457	4,335	United Kingdom 2,023.
Gold, unworked or partly worked troy ounces	7,359	96,227	U.S.S.R. 80,216; West Germany 6,752.
Iron and steel:			
Ore and concentrate, except roasted pyrite	837,310	637,895	Norway 416,295; Sweden 221,600.
Roasted pyrite	4	3,192	Norway 2,398; Rumania 794.
Metal:			
Scrap	122,551	111,861	U.S.S.R. 105,638.
Pig iron, including cast iron	2,773	4,797	Norway 4,736.
Sponge iron, powder and shot	2,232	1,979	Sweden 1,057.
Ferroalloys	9,475	10,914	U.S.S.R. 4,547; Norway 3,889.
Steel, primary forms	62,814	51,210	United Kingdom 21,915; U.S.S.R. 18,727.
Semimanufactures:			
Bars, rods, angles, shapes, sections	141,052	120,952	Sweden 29,501; West Germany 25,458; U.S.S.R. 18,213; Poland 15,651.
Universals, plates, sheet	380,913	411,020	U.S.S.R. 93,687; United Kingdom 81,454; Sweden 51,602; Common Market 134,921.
Hoop and strip	30,975	24,747	West Germany 9,767; United Kingdom 6,703.
Rails and accessories	1,161	1,296	West Germany 988.
Wire	16,577	15,591	Sweden 3,624; United Kingdom 3,508.
Tubes, pipes, fittings	80,704	83,142	West Germany 35,039; Czechoslovakia 10,295.
Castings and forgings, rough	299	289	NA.
Lead:			
Oxides	641	533	Sweden 371.
Metal, including alloys:			
Unwrought	14,392	8,529	U.S.S.R. 5,523; Sweden 1,422.
Semimanufactures	1,233	840	West Germany 598.
Magnesium metal, including alloys, all forms	17	36	Norway 35.
Manganese:			
Ore and concentrate	59,006	11,859	Belgium-Luxembourg 10,020.
Oxides	574	580	Netherlands 268; Republic of South Africa 203.
Mercury 76-pound flasks	1,015	638	Netherlands 290.
Molybdenum metal, including alloys, all forms	4	2	NA.
Nickel:			
Ore and concentrate	r 9	540	Norway 538.
Metal, including alloys:			
Scrap	395	80	United States 45; West Germany 24.
Unwrought	253	242	United Kingdom 110; U.S.S.R. 100.
Semimanufactures	186	236	Switzerland 100; United Kingdom 49.
Platinum group thousand troy ounces	6	2,750	West Germany e 1,540; U.S.S.R.e 825.
Silver, including alloys do	1,838		
Silicon, elemental	130	143	Sweden 132.
Tin:			
Oxides long tons	19	16	Mainly from United Kingdom.
Metal, including alloys:			
Unwrought do	361	237	United Kingdom 70; China (mainland) 56.
Semimanufactures do	44	32	Mainly from United Kingdom.
Titanium oxides	768	10	NA.
Tungsten metal, including alloys, all forms	5	3	NA.
Zinc:			
Oxides	318	331	East Germany 93; United Kingdom 61.
Metal, including alloys:			
Blue powder	153	222	West Germany 115; Norway 90.

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Table 3.—Finland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Zinc—Continued			
Unwrought	7,097	6,741	Belgium-Luxembourg 2,946; U.S.S.R. 2,391.
Semimanufactures	408	388	West Germany 220.
Other:			
Ore and concentrate:			
Of titanium, vanadium, tantalum, and zirconium.	1	57,019	United Kingdom 56,998.
Of base metals, n.e.s.	319	35	Argentina 30.
Ash and residue containing nonferrous metals.	1,030	489	West Germany 487.
Metals, including alloys, all forms:			
Metalloids, n.e.s.	62	42	West Germany 20; Sweden 19.
Pyrophoric alloys	2	2	Austria 1.
Base metals, n.e.s.	83	108	Sweden 48; United Kingdom 33.
NONMETALS			
Abrasives, natural, n.e.s.—value, thousands	$177	$212	United States $115.
Asbestos	6,393	6,431	U.S.S.R. 3,889; Canada 1,581.
Barite and witherite	516	646	West Germany 565.
Borates, natural, crude	2,428	2,539	United States 2,507.
Cement	8,334	7,475	United Kingdom 3,241; Denmark 3,142.
Chalk	11,398	10,209	France 4,006; Denmark 3,105; Sweden 2,665.
Clay and clay products:			
Crude clays	239,272	245,377	United Kingdom 225,515.
Clay products:			
Refractory (including brick)	20,857	46,067	U.S.S.R. 19,696; Sweden 8,541.
Nonrefractory—value, thousands	$916	$637	Sweden $300.
Cryolite and chiolite, natural	47	62	All from Denmark.
Diamond:			
Gem, not set or strung—value, thousands	$215	$190	Belgium-Luxembourg $72; United Kingdom $37.
Industrial—do	$162	$143	Belgium-Luxembourg $96.
Feldspar	1,040	1,264	Sweden 643; Norway 616.
Fertilizer materials:			
Crude, phosphatic	387,149	351,834	U.S.S.R. 245,009; Morocco 106,825.
Manufactured:			
Nitrogenous	121,981	77,215	Norway 49,085; West Germany 27,922.
Phosphatic:			
Thomas (basic) slag	11,349	13,686	Sweden 13,384.
Other	1,598		
Potassic	188,269	180,579	East Germany 61, 545; U.S.S.R. 56,680.
Other, including mixed	3,293	1,145	Belgium-Luxembourg 1,106.
Ammonia	13,409	20,260	Trinidad and Tobago 12,487.
Fluorspar	4,917	4,356	France 1,240; United Kingdom 940.
Graphite, natural	393	346	Poland 200.
Gypsum and plasters	109,190	114,739	Poland 74,888; U.S.S.R. 19,109.
Lime	30	16	NA.
Magnesite	2,038	2,059	West Germany 1,651.
Mica, all forms	764	521	United Kingdom 367.
Pigments, mineral:			
Natural, crude	115	600	Belgium-Luxembourg 475.
Iron oxides, processed	1,142	1,258	West Germany 972.
Precious and semiprecious stone, except diamond:			
Natural—value, thousands	$272	$239	West Germany $137.
Manufactured—do	$169	$195	West Germany $133.
Pyrite	800	-------	
Salt (excluding brines)	376,010	352,344	Netherlands 169,142; East Germany 74,239.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	2,293	5,403	United Kingdom 2,100.
Caustic potash	354	296	West Germany 128.
Stone, sand and gravel:			
Dimension stone	2,042	2,164	Sweden 645; Italy 482.
Dolomite, chiefly refractory grade	6,307	3,778	Belgium-Luxembourg 3,000.
Gravel and crushed rock	1,367	4,226	Sweden 3,306.
Limestone, except dimension	184,671	224,919	Mainly from Sweden.
Quartz and quartzite	4,767	1,699	Sweden 1,465.
Sand, excluding metal-bearing	98,104	84,640	Belgium-Luxembourg 58,038.
Sulfur:			
Elemental, all forms	78,952	51,235	United States 23,480; France 18,950.
Sulfuric acid	19,856	30	NA.
Talc and steatite	4,994	4,919	China (mainland) 1,695; Norway 1,680.
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal-bearing:			
From manufacture of iron and steel	48,738	5,925	Belgium-Luxembourg 4,350; Sweden 1,575.
Slag and ash, n.e.s.	100	2,300	Switzerland 2,100.

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Table 3.—Finland: Imports of mineral commodities—Continued

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Other mineral materials	4,643	1,231	Republic of South Africa 470; United Kingdom 340.
Oxides and hydroxides of magnesium, strontium, and barium.	4,874	6,812	Norway 4,711.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	310	315	United Kingdom 143; United States 135.
Carbon black	3,451	3,172	Netherlands 1,465; United Kingdom 998.
Coal, all grades, including briquets. thousand tons	2,048	2,059	Poland 1,633; U.S.S.R. 418.
Coke and semicoke do	727	736	U.S.S.R. 616.
Gas, hydrocarbon, liquefied do	2	6	Netherlands 3.
Petroleum:			
Crude and partly refined do	2,901	4,970	U.S.S.R. 3,788; Iran 1,182.
Refinery products:			
Gasoline do	19	102	Sweden 27; Netherlands 25.
Kerosine do	32	26	Mainly from U.S.S.R. and Netherlands Antilles.
Distillate fuel oil do	2,314	1,861	U.S.S.R. 1,763.
Residual fuel oil do	1,617	978	U.S.S.R. 874; Rumania 104.
Lubricants do	80	68	United Kingdom 32; Sweden 15.
Other do	151	223	Venezuela 177.
Mineral tar and other crude chemicals derived from coal, petroleum or gas.	68	17	U.S.S.R. 9.

• Estimate. ' Revised. NA Not available.

COMMODITY REVIEW

METALS

Chromite.—The sharp rise in output of chromite in 1968 was apparently due to requirements of the new ferrochromium plant at Tornio. (See Ferroalloys.) Crude ore production was 107,000 tons (30,000 tons in 1967). Average chromic oxide content in the crude ore was 25 percent (22 percent in 1967) and 41.3 percent in the concentrates (44.1 percent in 1967).

Cobalt.—The new plant at Kokkola for recovering cobalt from pyrite was operated for the first year in 1968. Metal production was approximately 40 percent of plant capacity, and amounted to an estimated 4 percent of world output. A metallurgical process developed by Sherritt Gordon Mines, Ltd., of Canada, was used to recover the metal, which was obtained mainly from pyrite produced at the Outokumpu mine.

Explorations for cobaltous pyrite were reportedly conducted in the Kuusamo area, about 150 miles northeast of Oulu, by Suomen Malmi Oy. A 90,000-ton deposit of pyrite and pyrrhotite, containing approximately 0.3 percent of cobalt and small quantities of copper and gold, was found in the area 10 years ago but the cobalt values were considered insignificant until the Kokkola plant was built.

Copper.—Ore production at the new Luikonlahti mine, 25 miles northwest of Outokumpu, began in 1968 and 4,000 tons of concentrates was reportedly produced. Operated by a private company, Malmikaivos Oy., the mine is expected to produce about 450,000 tons of ore annually. Ore reserves reportedly total 8 million tons containing 1.5 percent copper and 1 percent zinc.

Near Outokumpu, development of the Vuonos deposit was continued and production was scheduled to begin by 1971 at the rate of at least 300,000 tons annually. The Vuonos orebody reportedly contains approximately 3 percent copper. Elsewhere, exploration of the Säviä deposit was continued at Pielavesi.

The increased output of mine copper in 1968 was partly the result of increased production of byproduct concentrates at the Vihanti and Pyhäsalmi mines. Copper concentrate was produced by seven mines in 1968, as shown by the accompanying tabulation:

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Mine	Principal product	Copper concentrate, metric tons	
		1967	1968
Outokumpu	Copper	89,433	86,496
Pyhäsalmi	Pyrite	25,497	27,489
Vihanti	Zinc	9,350	12,153
Virtasalmi	Copper	5,718	6,062
Kotalahti	Nickel	3,069	3,729
Luikonlahti	Copper	-------	4,000
Aijala	Zinc	245	970
Total		133,312	140,899

A Honeywell DDP–516 computer was ordered by Outokumpu Oy. for control of copper flotation at the Pyhäsalmi plant. The system was scheduled for installation in mid-1969. In other developments, the Outokumpu flash-smelting process for copper sulfide was licensed to three more Japanese firms and to one firm in Turkey. The process was also sold to a Brazilian company, for treatment of pyrite cleaned from coal.

Iron and Steel.—*Iron Ore.*—Closing of the Jussarö and Kärväsvaara mines reduced the output of magnetite concentrates in 1968, but the loss in volume was largely made up by a 100,000-ton increase in byproduct iron ore obtained from processing of pyrite at Kokkola. The overall supply position, including imports and exports, did not appear significantly changed from 1967.

The Jussarö mine, which normally produced about 110,000 tons of concentrate annually, apparently became uneconomic and was closed by Vuoksenniska Oy. in late 1967. The Kärväsvaara mine, with a normal production of 50,000 to 70,000 tons of concentrate, became depleted and was closed by Otanmäki Oy., probably in 1968. The latter company continued to operate the Raajärvi and Otanmäki mines which produced 262,000 tons and 246,000 tons, respectively, in 1968. Both mines are now underground operations, as openpit mining ceased at Raajärvi in mid-1968.

Otanmäki Oy. was officially merged with Rautaruukki Oy. on December 31 and all operations are now carried on under the name of the latter company. About 1 year previously, Vuoksenniska Oy., which operates blast furnaces at Koverhar (Hanko) and Turku and a steelworks at Imatra, was taken over by a Finnish bank, Pohjoismaiden Yhdyspankki Oy.

Ferroalloys.—Production of ferrochromium began in 1968 at Tornio, on the Gulf of Bothnia near the Swedish border. The plant, which is the only one in Finland, was built by Outokumpu Oy. to utilize chromite mined from deposits near Kemi. Production capacity of the plant was reported to be 30,000 tons annually.

Imports of ferroalloys rose 36 percent to nearly 15,000 tons in 1968, owing to increased steel production. Imports of ferrochromium continued to comprise about 9 percent of the total, but were expected to decrease in 1969 as domestic production increases.

Pig Iron.—Rautaruukki Oy. produced 610,000 tons of pig iron at Raahe, mostly from domestic iron concentrates. Vuoksenniska Oy., using imported ore, produced 289,000 tons of iron at Koverhar and 140,000 tons at Turku. About half the output at Raahe and three-fourths of the Vuoksenniska production was probably exported.

Exports of pig iron were 100,000 tons less than in 1967. The difference was probably due to increased consumption for steelmaking at Raahe.

Steel.—The sharp increase in output of crude and rolled steel in 1968 was due to the first year's operation of the oxygen-steelworks at Raahe, which was commissioned by Rautaruukki Oy. in late 1967. Although production figures were not available, it appeared likely that output at Raahe was at least 50 percent of rated annual capacity which was 600,000 tons of crude steel and 300,000 tons of heavy plate. Production of steel at the Imatra works, in electric furnaces, was reported to be 224,000 tons in 1968.

There were marked changes in exports and imports of plates and sheets in 1968. As compared with 1967 figures, exports increased by 75,000 tons and imports were reduced by 100,000 tons. There was also a reduction of 30,000 tons in imports of ingots and other crude forms.

Plans were announced by Rautaruukki to construct a rolling mill for steel sheet, adjacent to the plate mill at Raahe. The mill, to be completed by 1971, will have a production capacity of ~230,000 tons annually. Cost of the plant was estimated at approximately $60 million.

Rare-Earth Metals.—A new source of rare-earth metals was indicated in the

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deposits of apatite discovered in Lapland near Savukoski. (See section on Fertilizer Materials.) No figures were available, but the apatite reportedly contains appreciable quantities of rare-earth metals and the deposits were said to be similar to those mined in the Kola Pensinsula of the U.S.S.R.

Rare-earth oxides have been produced in Finland for a number of years, apparently from Kola apatite processed by Typpi Oy., a State-owned fertilizer company. In 1967 the company increased its production capacity for rare-earth oxides to 400 or 500 tons annually in order to process lanthanide concentrates obtained as by-products of lead ore produced at the Korsnas mine. The concentrates contain 2.5 to 3.5 percent rare-earth oxides and 300 grams of europium per ton.

Vanadium.—Exports of vanadium pentoxide from Finland were valued at $1.2 million less than in 1967, even though the quantity shipped increased. This reflected a fall in world prices for vanadium and drew attention to the competition faced by Otanmäki Oy., the Finnish producer, due to increasing supplies of vanadium from the Republic of South Africa and the United States.

Zinc.—A Finnish firm, Rauma-Repola Oy., was awarded a $1.4 million contract to supply leaching and purification equipment for the zinc refinery to be built at Kokkola by Outokumpu Oy. Production capacity of the plant will be 70,000 tons of zinc annually.

NONMETALS

Cement and Other Construction Materials.—The construction industry was generally depressed through the first 9 months of 1968. Although building starts began to increase in the latter part of the year, building production was expected to be 10 percent less than in 1967. Output of lime and cement was the lowest in 5 years, and cement production was only about 60 percent of the total capacity. Trade in construction-related commodities was static, except for exports of asbestos and feldspar which increased considerably. Although general conditions were definitely improving by yearend, the strength of the revival depended primarily on private rather than government expenditures and this factor was uncertain.

Fertilizer Materials.—Discovery of large but low-grade deposits of apatite was reported in 1968 in the Savukoski area of Lapland, northeast of Kemijärvi. The deposits, occurring in a carbonatite complex, contain only about 11 percent phosphorus pentoxide but the apatite reportedly contains appreciable quantities of rare-earth metals which would increase its value. Exploration of the area was being continued by Otanmäki Oy.

Another deposit of apatite, at Siilinjärvi in the Kuopio region of central Finland, was being developed by Apatiiti Oy., a State company formed by Typpi Oy. and the chemicals company, Rikkihappo Oy. The deposit reportedly contains 30 percent apatite, and potential reserves are extremely large.

Successful exploitation of either deposit would be advantageous to Finland since all raw phosphate is now imported. Annual consumption of phosphate rock is approximately 400,000 tons, and imports, mostly from the Soviet Union and Morocco, were valued at $8.4 million in 1968.

Consumption of fertilizer materials in Finland for the agricultural years 1966–67 and 1967–68 is tabulated as follows:

Fertilizer type	Thousand metric tons	
	1966–67	1967–68
Nitrogen:		
Compound fertilizer	61.7	73.5
Calcium nitrate [1]	38.1	42.0
Other	-----	0.1
Total	99.8	115.6
Phosphorus (P_2O_5):		
Compound fertilizer	109.6	134.5
Superphosphate	14.2	14.0
Other	8.6	4.6
Total	132.4	153.1
Potassium (K_2O):		
Compound fertilizer	88.7	104.1
Potassium chloride	9.1	8.2
Other	7.5	1.4
Total	105.3	113.7

[1] Including calcium ammonium nitrate.

Source: British Sulphur Corporation. Nitrogen, No. 57, Phosphorus and Potassium, No. 89. (January–February 1969).

Pyrite and Sulfur.—Increased output of pyrite from the Vihanti and Pyhäsalmi mines was responsible for the record production of recovered sulfur in 1968. Additional production was likely in 1969,

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especially from the Luikonlahti copper mine where the ore is reported to contain more than 50 percent of pyrrhotite and pyrite. Sulfur concentrates from the latter mine may be used for manufacture of fertilizer in southeast Finland.

The present mine sources of pyrite concentrate are shown in the following tabulation:

Mine	Pyrite concentrates, metric tons	
	1967	1968
Pyhäsalmi	446,728	472,881
Outokumpu:		
Mine	169,572	158,428
Old tailings	56,240	55,977
Vihanti	33,889	81,679
Otanmäki	5,200	• 5,000
Total	711,629	773,965

The increased recovery of gaseous and elemental sulfur from pyrite at Kokkola has made possible a 45,000-ton reduction in annual imports of sulfur since 1966.

Talc.—Since 1962, talc from deposits near Sotkamo, central Finland, has been investigated as a substitute for imported kaolin in the Finnish paper industry. The investigation appeared to be successful, as an open-pit mine was being developed in 1968 by Suomen Talkki Oy. Production was scheduled to begin in mid-1969, at an initial rate of 200,000 tons of crude ore and 70,000 tons of concentrate annually. The open-pit ore reserves were reported to be 15 million tons. The deposit contains about 50 percent magnesite and is said to closely resemble deposits at Johnson, Vt.

Initially, three filler grades of talc will be produced from a basic flotation concentrate containing 95 percent talc. Later, production will include three grades of micronized talc.

MINERAL FUELS

Atomic Energy.—In late July, the Government's plans to build Finland's first nuclear powerplant were temporarily abandoned. Bids had been received from Sweden, the United Kingdom, and the Soviet Union, with each proposing a different type of reactor. Apparently, the plans were abandoned because of unresolved questions including safety, supply of fuel, and the extent of participation of Finnish industries. Until these questions can be resolved, additional supplies of electricity will be furnished by conventional hydro and thermal plants or from imported power.

Coal and Coke.—Finland continued to import almost all solid fuels from the Soviet Union (coke) and Poland (coal). Value of imports of solid fuels in 1968 was $16.3 million from the U.S.S.R. and $14 million from Poland. Total imports included 2,094,000 tons of coal and briquets and 662,000 tons of coke.

A trade agreement between Finland and the U.S.S.R. in November 1968 provided that Soviet exports of coal and coke to Finland would continue at about the same level during 1969.

The approximate consumption of coal and coke in Finland in 1967 and 1968 is shown in the following tabulation, in thousand metric tons:

	1967	1968
Coal:		
Electric power generation	415	854
Locomotive fuel	114	82
Paper and wood industry	598	780
Other industries	412	428
Gas and coke manufacturing	198	161
Space heating	74	58
Total	1,801	2,358
Coke:		
Metals reduction	784	782
Other industries	9	4
Space heating	136	65
Total	879	801

Petroleum.—Imports of crude oil in 1968 continued to be supplied by the Soviet Union and Iran, but there was a marked change in relative volume in favor of the U.S.S.R. Of the total import of 5.8 million tons, the Soviet share was almost 90 percent, as compared with 75 percent in 1967.

The expansion of annual processing capacity at the Porvoo refinery to 5.5 million tons was completed in October. Combined processing capacity of the refineries at Porvoo and Naantali was between 8.0 and 8.5 million tons annually at yearend.

Apparent consumption of petroleum products was 8.3 million tons. This indicated an increase of about 10 percent in 1968, compared with 5 percent in 1967 and 19 percent in 1966. The quantity of imports of petroleum products was almost unchanged from 1967, while exports fell to 131,000 tons and refinery production rose by 716,000 tons.

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The Mineral Industry of France

By L. Nahai [1]

Despite the strikes of May–June and the monetary crisis in November, the principal sectors of the mineral and energy producing industry performed well. Only for solid fuels did the index of production decline. The gross national product increased about 8.6 percent in current and 4 percent in real terms. Prior to the strike, industrial production increased 7 percent compared with 1967 levels, principally because of foreign demand. Recovery after the strike started in August and gained momentum in the last quarter.

The value of crude mineral output in 1967, the last year for which complete data are available, was about $1,750 million,[2] equivalent to 1.5 percent of the gross domestic product for the same year. Distribution of mineral output value by commodity groups was as follows, in million dollars: Energy products (including uranium), 828; quarry products, 570; nonmetallic minerals other than quarry products, 188; and metallic minerals 164. Solid fuels ranked first in value ($645 million), followed by sand and gravel ($220 million) and iron ore ($140 million).[3]

As of December 31, 1967, personnel employed in the extractive industry, other than quarrying, totaled 203,622, a decline of 16,690 from the December 1966 total. Declines in employment at coal mines (163,074) accounted for 13,023 persons, and at iron mines (14,967) for 2,492. There were no significant changes in other segments. About 48,000 were employed in quarries. Cement and lime plants employed about 16,000. For 1968 the total of the above may have been about 255,000. The iron and steel industry (inclusive of foundries) employed an average of 108,647 workers, and 38,809 salaried employees in 1968. Corresponding data for nonferrous metal plants and the petroleum industry are not available. It is estimated that total employment in the extractive industry (including quarries), nonferrous and ferrous metallurgy, and petroleum exploration, production, and refining may have totaled 520,000.

Law number 68–1181, "Relative to the Exploration of the Continental Shelf and to the Exploitation of its Natural Resources," was approved in December and published in the Journal Officiel on December 31. The Law constitutes the application of the Geneva Convention on the Continental Shelf of April 29, 1958, which France adhered to on June 14, 1965. Principal features of the Law are as follows:

> Prior authorization is required for exploration and exploitation of the French Continental Shelf; French laws and regulations concerning mining on land (Code Minier) are made applicable to the Continental Shelf; French laws including penal and fiscal codes are extended to installations engaged in exploration and exploitation of the Continental Shelf which are also made subject to certain regulations concerning maritime security and safety of human life at sea; fiscal exonerations are provided to take into consideration the high cost of offshore exploration and production and thereby encourage their activity.

The Bureau de Recherches Géologiques et Minières (BRGM) and a number of other companies organized Société de Récherches de Minerais en Mer (Mineramer) to study and exploit marine mineral resources.

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[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from francs (Fr.) to U.S. dollars at the rate of Fr. 1=U.S. $0.20225.

[3] Ministère de l'Industrie. Bureau de Documentation Minière. Statistiques de l'Industrie Minérale 1968. (Ministry of Industry. Statistics of the Minerals Industry, 1968). Paris, France, February 1969, p. 8.

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PRODUCTION

Generally the effect of the labor strike on the mineral industry was not as severe as might have been expected. Iron mining recovered from its 1967 level; it should be noted, however, that the 1967 output was adversely influenced by a long strike. Pig iron and crude steel production also increased moderately and output of electric furnace ferroalloys increased by about 3 percent. Although production of domestic lead and zinc concentrates declined, the output of the corresponding metals increased. The picture was similar for bauxite and aluminum with the production of the ore declining and that of the metal increasing. Among the nonmetals, production of both potash and sulfur declined but that of salt increased. Coal output and crude refinery throughput continued their past trends of decline in one and increase in the other. Production of electricity increased 5.61 percent from 111,637 million kilowatt-hours in 1967 to 117,900 million kilowatt-hours in 1968. Thermal power accounted for 57 percent of the total.

Table 1.—France: Indexes of industrial production

(1959 =100)

	1967	1968	Change, 1967–68 (percent)
All industrial production including construction	155	160	3.2
All industrial production excluding construction	153	160	4.6
Solid fuels	85	76	−10.6
Petroleum and refined products	244	259	6.1
Electricity	176	186	5.7
Metal ore mining	88	97	10.2
Mining and preparation of miscellaneous minerals	123	125	1.6
Construction material mining	178	196	10.1
Metal production	131	138	5.3
Ceramics and building material fabrication	170	176	3.5
Chemical industry	221	242	9.5
Building and public works	162	161	−.6

Source: Ministère de l'Industrie. Bulletin Mensuel de Statistique Industrielle. Paris, France, January and April 1969.

Table 2.—France: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, gross weight—thousand tons	2,433	2,662	2,811	2,813	2,800
Alumina:					
Hydrates [1]	805,683	873,825	962,799	1,024,000	1,026,000
Calcined	741,139	772,928	844,897	914,000	949,000
Metal:					
Primary	315,990	340,528	363,511	r 361,214	365,600
Secondary	50,340	50,250	59,609	63,000	74,000
Semimanufactures	177,582	177,368	213,165	225,577	233,000
Castings	r 88,970	r 91,970	r 109,000	105,400	110,000
Antimony:					
Mine output, content of ore	108	121	279	r 167	NA
Metal	639	790	834	r 1,091	NA
Arsenic [2]	8,595	9,187	9,038	r 10,646	NA
Beryllium metal—kilograms	14,281	NA	NA	NA	NA
Bismuth metal—do	56,065	48,260	69,006	60,515	60,000
Cadmium metal	492	428	448	499	e 550
Chromium metal	460	629	NA	NA	NA
Cobalt metal	749	889	840	919	e 800

See footnotes at end of table.

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Table 2.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS—Continued					
Copper:					
Mine output, metal content	267	283	434	405	• 400
Metal:					
Blister (secondary)	r 8,500	11,000	r 10,400	7,700	NA
Refined:					
Electrolytic	30,700	31,900	31,400	29,000	28,000
From scrap	7,200	9,200	11,300	8,000	8,000
Total	37,900	41,100	42,700	r 37,000	36,000
Gold:					
Mine output, metal content—troy ounces	54,303	57,389	60,154	r 62,700	NA
Metal—do	53,434	56,199	68,674	69,800	• 52,000
Iron and steel:					
Iron ore and concentrate—thousand tons	60,938	59,532	55,050	49,220	55,300
Pig iron (including blast furnace alloys) thousand tons	15,863	15,770	15,590	15,710	16,450
Of which spiegeleisen and high-carbon ferromanganese thousand tons	412	432	355	320	374
Other ferroalloys [3]	218	r 250	r 258	265	250
Steel, ingots and castings—thousand tons	19,780	19,604	19,585	19,655	20,410
Steel semimanufactures—do	14,619	14,793	14,873	14,847	15,711
Lead:					
Mine output, metal content	12,190	18,051	26,754	r 27,356	• 27,000
Metal:					
Primary	89,790	98,356	108,638	114,010	NA
Secondary	14,475	12,392	15,829	14,606	NA
Antimonial lead [4]	17,415	16,823	17,421	15,427	NA
Total refined lead	121,680	127,571	141,888	r 144,043	145,400
Magnesium metal, including secondary	989	2,841	3,419	4,164	4,500
Manganese:					
Ore and concentrate, gross weight	1,277	1,400	1,817	2,304	NA
Metal	1,734	2,704	NA	NA	NA
Nickel, metal content of pure nickel, ferro-nickel, and nickel oxide	7,661	6,418	12,782	11,717	r 10,500
Silicon	21,245	21,493	20,828	r 19,408	• 19,000
Silver:					
Mine output, metal content thousand troy ounces	r 969	r 1,401	r 2,008	r 2,163	• 2,000
Metal (content of final smelter products) thousand troy ounces	3,688	3,475	4,129	4,716	5,720
Tantalum—kilograms	170	NA	NA	NA	NA
Thorium	180	NA	NA	NA	NA
Tin concentrate, metal content—long tons	486	447	421	454	NA
Tungsten concentrate, gross weight	---	---	22	20	NA
Uranium:					
Mine output, metal content	1,009	1,118	1,094	r 1,100	1,110
Concentrate, metal content	1,470	1,580	1,647	1,640	1,640
Zinc:					
Mine output, metal content	16,841	20,902	23,294	r 24,669	• 22,000
Metal, including secondary:					
Slab	189,919	191,403	195,353	185,688	207,500
Dust	4,120	4,330	r 4,717	r 5,150	• 5,300
Zircon metal—kilograms	112,000	NA	NA	NA	NA
NONMETALS					
Alabaster	820	1,140	1,360	1,640	NA
Asbestos	22,035	10,141	300	r 150	NA
Barite	83,821	104,084	99,121	r 101,997	NA
Bromine, elemental	7,675	8,720	8,630	13,070	• 12,000
Cement, all types	21,537	22,365	23,304	24,400	25,400
Chalk—thousand tons	3,676	3,608	3,862	3,839	NA
Clays:					
Bentonite	17,328	15,527	14,365	14,687	NA
Brick and tile clay—thousand tons	9,993	10,530	9,960	9,934	NA
Ceramic and pottery clay	355,162	338,203	471,895	467,543	NA
Clay and marl for cement industry thousand tons	8,370	10,045	10,356	10,684	NA
Kaolin and kaolinitic clay	287,475	295,392	435,444	438,160	NA
Refractory clay—thousand tons	1,057	1,034	712	781	NA
Diatomite	133,083	150,635	141,258	159,624	NA
Feldspar and pegmatites	196,361	221,141	222,162	179,843	NA

See footnotes at end of table.

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Table 2.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Fertilizer materials:					
Crude (natural):					
Phosphatic chalk	43,109	34,590	36,420	64,500	NA
Potash:					
Gross weight—thousand tons	11,406	11,832	11,537	11,694	• 11,800
K_2O equivalent—do	1,807	1,879	1,910	1,818	1,719
Manufactured:					
Nitrogenous, nitrogen content [5] thousand tons	1,096	1,102	1,251	• 1,270	• 1,350
Phosphatic:[6]					
Superphosphate, gross weight thousand tons	1,576	1,553	1,450	1,496	• 1,500
Thomas slag—do	2,433	2,445	2,466	2,369	• 2,400
Mixed, gross weight [6]—do	5,148	5,062	5,352	6,187	• 6,528
Fluorspar	195,153	195,565	215,435	250,000	270,000
Fly ash—thousand tons	4,583	4,022	3,379	4,120	NA
Gypsum and anhydrite, crude—thousand tons	4,912	5,012	5,272	5,192	NA
Lime:					
Hydraulic—thousand tons	791	831	855	1,137	• 1,160
High-grade (fat lime)—do	2,917	2,825	2,910	2,921	• 2,800
Mica	293	195	223	286	NA
Pigments, natural mineral, iron oxide	5,265	4,513	3,145	5,049	NA
Pumice	916	708	806	626	NA
Pozzolana and lapilli	585,631	709,543	671,650	723,385	• 600,000
Pyrite, gross weight	191,341	134,361	88,076	85,380	82,000
Quartz and glass sand:					
Quartz	302,165	315,683	438,082	415,502	NA
Glass sand	1,438	1,613	1,411	1,760	NA
Salt—thousand tons	4,032	4,449	4,462	3,469	3,370
Stone, sand and gravel, n.e.s.:					
Building stone:					
Granite and similar rocks thousand tons	1,034	1,127	984	1,008	NA
Limestone—do	3,850	3,019	2,612	2,886	NA
Marble—do	245	501	515	516	NA
Other—do	127	123	192	122	NA
Crushed limestone and granite	4,080	3,890	3,684	4,103	NA
Dolomite:					
For agriculture	92,495	130,540	117,485	136,660	NA
Crude for calcining	611,552	668,930	747,706	702,435	NA
Other	416,150	500,867	520,366	629,082	NA
Total	1,120,197	1,300,337	1,385,557	1,468,177	
Limestone, agricultural and industrial:					
For agriculture—thousand tons	749	702	642	586	NA
For iron and steel industry—do	5,071	5,105	4,835	4,355	NA
For lime and cement—do	21,339	22,367	23,122	26,169	NA
For sugar mills—do	735	672	483	466	NA
Total—do	27,894	28,846	29,082	31,576	NA
Road building, foundation and ballast (other than alluvial sand and gravel):					
Ballast—thousand tons	52,279	57,793	63,475	69,580	NA
Foundation material—do	5,329	4,675	7,155	6,110	NA
Ground rock for road filler—do	87	151	557	108	NA
Paving block and curbing—do	230	139	139	r 132	NA
Slate:					
Roof	121,319	121,211	122,583	124,013	• 100,000
Other	45,700	56,763	r 51,461	r 56,710	NA
Other stone:					
Beach pebble	174,943	170,326	169,000	53,541	NA
Lava	13,388	9,786	10,794	13,065	NA
Marl	217,272	224,654	176,664	242,537	NA
Mine fill—thousand tons	12,719	12,665	12,379	12,107	NA
Millstones and grindstones	1,113	1,202	1,548	1,508	NA
Sand and gravel:					
Industrial sands:					
Foundry—thousand tons	1,692	1,697	1,635	1,533	NA
Miscellaneous—do	451	452	584	430	NA
Other sand and gravel (alluvial):					
By dredging—thousand tons	61,918	66,999	73,483	80,686	• 173,000
By other winning methods thousand tons	48,490	54,353	59,059	71,973	
Sulfur, elemental—do	1,511	1,521	1,540	1,665	1,600
Talc	205,400	240,288	224,076	217,353	210,000

See footnotes at end of table.

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Table 2.—France: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
MINERAL FUELS AND RELATED MATERIALS					
Bituminous asphaltic material	107,608	117,000	131,249	130,573	NA
Carbon black	85,960	99,800	120,250	118,760	NA
Coal:					
Bituminous and anthracite thousand tons	53,042	51,348	50,338	47,625	41,911
Lignite do	2,244	2,690	2,564	2,931	3,221
Coke do	14,364	13,670	13,214	12,639	12,511
Coal briquets do	6,638	5,806	5,050	4,839	4,548
Gas natural:					
Gross production million cubic feet	280,362	r 279,765	r 279,295	r 303,005	305,000
Marketed do	179,751	178,268	182,258	r 196,455	r 200,657
Peat thousand tons	50	47	58	83	NA
Petroleum:					
Crude do	2,845	2,988	2,932	2,832	2,688
Refinery products do	50,376	57,596	63,139	75,200	79,500

• Estimate. p Preliminary. r Revised. NA Not available.
[1] Hydrated and calcined alumina are successive stages of alumina production and are not to be added.
[2] Arsenic content of final products.
[3] Ferromolybdenum, ferrotungsten and ferrovanadium data are for contained metal.
[4] Lead content.
[5] From July 1 to June 30 of the succeeding year.
[6] From May 1 to April 30 of the succeeding year.

TRADE

Mineral commodity trade as a part of total French commodity trade is shown in the following tabulation:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1966	2,064	10,886	19.0
1967	r 2,074	11,383	r 18.2
1968	2,037	12,705	16.0
Imports:			
1966	3,456	11,840	29.2
1967	r 3,592	12,406	r 29.0
1968	4,116	13,982	29.4
Trade balance:			
1966	—1,392	—954	XX
1967	—1,518	—1,023	XX
1968	—2,079	—1,277	XX

r Revised. XX Not applicable.

Iron and steel (including scrap), petroleum products, and nonferrous minerals and metals (including semimanufactures) were the most important export items in the mineral field accounting for about 7.4, 2.1, and 3.1 percent, respectively, of all French exports.

Mineral fuels remained dominant among mineral imports accounting for 45 percent of the value of the tabulated mineral and metal imports and 13.3 percent of all imports.

The other countries of the European Economic Community (EEC) and the countries of the European Free Trade Association (EFTA) remained France's most important trading partners. In 1968, 42.9 percent of all exports of France went to other EEC countries and 14.6 percent to EFTA countries. The corresponding import figures were 47.3 and 11.3 percent.

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Table 3.—France: Summary of mineral commodity trade in 1968

(Thousand metric tons and thousand dollars)

Commodity	Exports		Imports	
	Quantity	Value	Quantity	Value
METALS				
Iron and steel:				
Iron ore, including pyrite cinder	18,481	$55,132	5,051	$48,387
Scrap	2,192	81,172	372	15,113
Pig iron, ferroalloys, sponge iron, powder, shot and grit	362	57,880	325	46,518
Primary steel forms and iron and steel semimanufactures	6,652	803,362	4,820	593,426
Other:				
Ores	191	6,820	2,183	131,729
Scrap and other metal-bearing waste	61	41,418	46	20,690
Metal oxides for paint and other uses	309	38,574	83	25,227
Metals including semimanufactures:				
Precious	(1)	70,701	1	141,852
Mercury, metaloids, alkali, akaline earth and rare	54	7,842	29	9,264
Other base	377	280,598	592	610,435
Ashes and residues	1,198	18,052	9,992	184,809
Total	29,877	1,461,051	23,494	1,827,445
NONMETALS				
Abrasives, natural, including industrial diamond	(1)	1,496	31	6,864
Cement, lime, worked dimension stone and other building materials	2,062	31,505	490	28,060
Fertilizer materials:				
Crude	96	1,873	3,435	52,692
Manufactured, including Thomas slag	1,906	62,736	1,836	52,427
Stone, sand and gravel, except worked dimension stone	12,750	20,184	6,293	34,114
Other	2,584	135,610	2,727	243,215
Total	19,398	253,404	14,812	416,872
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	44	8,821	53	11,565
Coal, lignite, coke, peat and briquets thereof	1,090	20,177	15,798	300,161
Gas, natural and manufactured	504	17,256	1,581	9,660
Petroleum:				
Crude	---	---	77,176	1,387,149
Products	10,917	272,897	5,192	153,101
Crude chemicals distilled from coal, petroleum, and/or natural gas	63	3,604	224	10,115
Total	12,618	322,755	100,024	1,871,751
Grand total	61,893	2,037,210	138,330	4,116,068

[1] Less than ½ unit.

Table 4.—France: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
METALS				
Aluminum:				
Bauxite	280,173	158,255	91,911	West Germany 86,050; United Kingdom 59,355.
Oxide and hydroxide [2]	158,088	204,299	24,869	Switzerland 77,459; Spain 53,331; United States 19,647.
Metal, including alloys:				
Scrap	15,244	16,859	16,644	Italy 12,286; West Germany 3,977.
Unwrought	171,043	140,282	94,484	Belgium-Luxembourg 61,289; mainland China 23,854; Italy 17,724.
Semimanufactures	58,144	67,403	31,867	West Germany 12,426; United States 11,001; Belgium-Luxembourg 7,607; Italy 7,228.
Antimony: Metal, including scrap	61	53	10	Spain 17; Algeria 16.
Arsenic (anhydride)	10,889	12,715	1,820	United States 5,164; Japan 1,750; Italy 1,336.

See footnotes at end of table.

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Table 4.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
METALS—Continued				
Beryllium	5	6	-------	All to the United States.
Bismuth	71	83	21	United Kingdom 61.
Cadmium	46	48	41	West Germany 38.
Chromium:				
Chromite	211	396	269	West Germany 257.
Oxide and hydroxide	1,054	592	231	Netherlands 134; Sweden 118; Denmark 105.
Metal	332	229	88	United States 87; West Germany 42.
Cobalt	605	608	112	United States 370.
Columbium—value, thousands	$1.2	$48	$45	Netherlands $23; Italy $19.
Copper:				
Ore	-------	172	170	NA.
Matte	692	223	223	Italy 105.
Metal and alloys:				
Scrap	39,532	43,479	40,239	West Germany 19,246; Belgium-Luxembourg 10,830; Italy 9,338.
Blister and other unrefined	15,900	12,453	12,373	Belgium-Luxembourg 7,033; West Germany 5,027.
Refined	15,607	14,020	11,742	Netherlands 3,975; West Germany 3,840.
Semimanufactures	31,379	29,510	10,780	United States 7,759; West Germany 4,804; Netherlands 4,062.
Gallium [3]—value, thousands	$170	$223	$16	Switzerland $186.
Germanium	4	1	1	Belgium-Luxembourg 1.
Gold: [4]				
Metal, including alloys. troy ounces	47,454	98,060	67,613	Netherlands 49,480; Switzerland 17,104.
Ashes and sweepings do	1,382	2,765	-------	United Kingdom 932; Switzerland 772.
Other metal (temporary imports and exports). do	103,429	64,173	19,998	Switzerland 30,061; Netherlands 12,378; Denmark 9,806.
Iron and steel:				
Iron ore—thousand tons	18,195	17,537	17,453	Belgium-Luxembourg 13,176; West Germany 4,277.
Pyrite cinder do	303	227	227	West Germany 195; Belgium-Luxembourg 32.
Metal:				
Scrap do	1,823	2,191	2,191	Italy 1,991.
Pig iron, [5] including spiegeleisen. do	83	95	88	West Germany 38; Belgium-Luxembourg 30.
Ferroalloys do	254	237	164	Italy 64; West Germany 48; Belgium-Luxembourg 45; United States 37.
Steel:				
Primary forms do	910	960	527	Italy 228; Belgium-Luxembourg 165; West Germany 122; Spain 95.
Semimanufactures:				
Bars, rods, sections. [6] do	2,369	2,251	890	West Germany 501; United States 426; Belgium-Luxembourg 201; Switzerland 128.
Universal plates and sheets. do	2,157	2,261	982	West Germany 642; Italy 192; Switzerland 172; United States 151.
Hoops and strips. do	225	202	114	West Germany 60; Italy 34; Switzerland 23; Belgium-Luxembourg 17.
Rails and accessories. do	90	138	56	Italy 48; Greece 31; Denmark 9; Iran 9.
Wire do	99	102	14	United States 32; West Germany 7; Morocco 7; Algeria 7.
Tubes, pipes and fittings. do	572	645	172	Netherlands 113; United States 56; Iran 51; Algeria 36.
Castings and forgings, rough. do	4	4	1	Canada 1.
Lead:				
Ore	1,637	3,893	3,764	Italy 2,175; Belgium-Luxembourg 1,579.
Oxides	7,171	7,779	2,201	Netherlands 1,832; United States 1,205; Czechoslovakia 1,121.
Metal including alloys:				
Scrap	2,276	9,615	9,450	Italy 8,880.
Pig, including alloys	9,225	18,025	1,774	United States 9,613; Switzerland 4,783.
Semimanufactures, including alloys.	1,012	902	163	Italy 116.

See footnotes at end of table.

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Table 4.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
METALS—Continued				
Magnesium, all forms	80	242	59	Greece 60; Cameroon 50; Sweden 30.
Manganese:				
Ore	763	1,136	770	Netherlands 418; Spain 190; Italy 190.
Oxide	213	406	80	Poland 115.
Metal, all forms	3,443	3,322	1,817	West Germany 897; Italy 887; United States 800.
Mercury—76-pound flasks	203	261	145	Belgium-Luxembourg 116; Austria 87.
Molybdenum:				
Ore	27	5	5	NA.
Oxide	71	29	26	Italy 23.
Metal, all forms	9	13	6	West Germany 4.
Nickel:				
Matte, speiss, etc	22	256	176	West Germany 117; United States 60.
Oxide and hydroxide	395	39	16	Italy 11.
Metal including alloys:				
Scrap	1,591	2,304	1,801	West Germany 832; Belgium-Luxembourg 484; United Kingdom 344.
Ingots	7,149	8,542	3,856	Mainland China 3,840; West Germany 1,458; Italy 1,227.
Semimanufactures, including anodes.	1,961	2,617	1,642	Netherlands 576; West Germany 682; Spain 313.
Platinum and platinum-group:[4]				
Ashes and sweepings—troy ounces	96	527,625	527,304	Italy 526,339.
Metal, including alloys—do	93,591	84,042	47,390	Netherlands 23,374; Spain 18,826.
Selenium	1	1	1	NA.
Silver:[4]				
Metal, including alloys. thousand troy ounces	6,131	2,314	1,426	Netherlands 844.
Ashes and sweepings—do	290	844	356	Sweden 488; Belgium-Luxembourg 342.
Sodium metal	2,624	2,522	2,410	Italy 2,400.
Tantalum, all forms. value, thousands	$50	$113	$89	United States $52; West Germany $30.
Thorium oxide	34	9	6	Hong Kong 3; West Germany 2.
Tin:				
Ore—long tons	560	524	-------	Spain 514.
Oxide—do	49	43	43	All to West Germany.
Metal including alloys:				
Scrap—do	46	18	17	West Germany 10.
Ingots—do	227	157	39	Algeria 32; Switzerland 31.
Semimanufactures—do	40	54	11	Belgium-Luxembourg 7.
Titanium:				
Ore	564	25	5	NA.
Oxide	5,867	13,807	4,462	United States 2,085; Italy 1,987; Japan 1,790.
Metal, all forms	36	32	19	West Germany 4.
Tungsten:				
Ore	3	34	11	United Kingdom 22; Netherlands 11.
Trioxide	112	87	20	Austria 67.
Metal, all forms	267	234	94	United Kingdom 90; West Germany 74.
Uranium and other radioactive materials:				
Ore	2,496	-------	-------	
Metal, including thorium. kilograms	NA	-------	-------	
Other radioactive material	478	-------	-------	
Zinc:				
Ore	237	219	219	All to Belgium-Luxembourg.
Matte	277	1,069	1,069	Italy 908; West Germany 141.
Oxide	7,578	7,496	1,170	Rumania 1,500; Turkey 942; West Germany 799.
Metal, including alloys:				
Scrap	1,511	2,228	2,228	Italy 2,063.
Dust (blue powder)	1,397	1,479	-------	Norway 1,200.
Slab and ingot	20,428	12,130	8,511	West Germany 7,978; Switzerland 2,066.
Semimanufactures	2,489	3,532	1,717	West Germany 1,710; Norway 1,200.

See footnotes at end of table.

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Table 4.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
METALS—Continued				
Zirconium:				
Ore	283	83	63	West Germany 54.
Oxide	82	88	61	Italy 46.
Metal, including nuclear grade	155	268	20	United States 109; Sweden 83.
Other:				
Ore and concentrate	105	119	47	West Germany 47.
Ashes and residues containing nonferrous metals:				
Aluminum	4,619	4,682	4,662	Italy 4,017.
Copper	3,990	5,039	5,039	West Germany 3,140; Belgium-Luxembourg 1,899.
Lead	5,351	10,318	10,246	Belgium-Luxembourg 9,595.
Nickel	754	952	948	West Germany 606.
Zinc	5,099	9,868	6,361	Belgium-Luxembourg 5,484; Sweden 3,507.
Other	31,330	38,223	21,870	Belgium-Luxembourg 18,710; Sweden 15,633.
Slag and ash, n.e.s	145,906	73,562	70,068	West Germany 52,541.
Metals, including alloys, all forms [7]	179	135	105	West Germany 91.
NONMETALS				
Abrasives, natural:				
Pumice, emery and other	612	495	150	NA.
Dust and powder of precious and semi-precious stones. value, thousands	$174	$409	$397	Belgium-Luxembourg $363.
Grinding and polishing wheels	2,383	2,200	1,390	Italy 686; West Germany 338; United States 119.
Asbestos, crude	1,928	1,087	337	Algeria 524.
Asbestos-cement products	51,577	29,036	12,030	West Germany 9,001; United Kingdom 3,789.
Barite, including witherite	12,900	18,154	5,679	Nigeria 4,920; United Kingdom 3,193; Belgium-Luxembourg 2,579; Italy 2,461.
Borates, natural	2,119	534	296	Italy 161.
Bromine	1,096	1,306	77	Switzerland 778; United Kingdom 402.
Cement thousand tons	854	928	298	West Germany 221; Spain 186; Ivory Coast 87; Cameroon 83.
Chalk	298,091	307,501	267,358	West Germany 125,365; Belgium-Luxembourg 77,234; Netherlands 44,269.
Clay and clay products:				
Crude:				
Kaolin	55,946	53,631	46,832	West Germany 38,564.
Bentonite	3,777	2,886	650	United Kingdom 716; Iran 633.
Refractory	332,532	316,340	288,662	Italy 170,822; West Germany 83,845.
Other	52,892	60,484	53,198	Belgium-Luxembourg 25,407; Italy 21,170.
Clay and refractory construction materials (bricks, tile, etc.).	174,001	162,854	91,821	West Germany 43,985; Belgium-Luxembourg 35,720.
Corundum:				
Natural, including emery	72	44	10	NA.
Artificial	13,858	12,355	6,763	Italy 3,532; Belgium-Luxembourg 1,752.
Cryolite and chiolite, natural	11	104	-------	Cameroon 101.
Diamond:				
Industrial, excluding powder. value, thousands	$1,366	$1,322	$845	West Germany $567; Sikkim (India) $202; Netherlands $189.
Gem, unset do	$4,859	$3,998	$1,001	United States $1,787; Netherlands $697.
Diatomite	19,787	17,136	15,288	West Germany 13,145.
Feldspar	23,467	19,924	15,035	West Germany 7,716; Belgium-Luxembourg 6,959.
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate).	-------	164	139	NA.
Phosphate rock	2,060	3,052	1,389	Switzerland 369.
Potassic salts	70,624	69,754	66,147	Belgium-Luxembourg 36,067; Netherlands 30,080.
Organic	36,454	32,065	10,973	Switzerland 15,892; West Germany 6,139.

See footnotes at end of table.

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Table 4.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
NONMETALS—Continued				
Fertilizer materials—Continued				
Manufactured:				
Ammonia, thousand tons anhydrous.	35	14	2	United Kingdom 5; Spain 4.
Nitrogenous do	720	1,056	87	Mainland China 351; Cuba 74; Yugoslavia 73; United Arab Republic 68.
Phosphatic:				
Basic slag do	343	350	38	Austria 160; Switzerland 133.
Other do	45	80	17	Cuba 22; Netherlands 13; Spain 11.
Potassic do	1,110	1,260	412	Belgium-Luxembourg 234; United States 143; United Kingdom 96.
Flint (pebbles)	78,753	87,233	35,495	United Kingdom 25,546; West Germany 14,193; United States 12,894.
Fluorspar	88,397	109,104	92,862	West Germany 64,471; Italy 20,099.
Graphite	1,788	2,633	1,164	United Kingdom 447; Italy 250; West Germany 221.
Gypsum and anhydrite, including plaster.	807,405	837,413	507,938	Belgium-Luxembourg 415,267; Sweden 184,447.
Iodine	85	115	98	NA.
Lime	240,391	253,422	214,262	West Germany 127,364; Belgium-Luxembourg 86,771.
Magnesite, including calcined	229	334	150	Algeria 84.
Mica	731	903	644	West Germany 538.
Pigments, mineral, including iron oxide	3,763	4,129	1,328	Netherlands 617; Morocco 480.
Pozzolan, santorin, etc	1,735	1,279	-------	NA.
Precious and semi-precious stones.[8] value, thousands	$9,769	$11,145	$1,182	Switzerland $5,411; United States $2,483; United Kingdom $780.
Pyrite, gross weight	-------	9,755	9,755	All to West Germany.
Salt	117,675	93,821	71,555	Belgium-Luxembourg 52,667; West Germany 12,523.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	159,178	232,171	23,628	Guinea 71,082; U.S.S.R. 23,315; Brazil 17,112.
Caustic potash	9,592	10,917	4,198	Netherlands 3,830; Switzerland 1,251; United Kingdom 1,233.
Stone, sand and gravel:[9]				
Building stone:				
Crude and partly worked, n.e.s.	106,465	104,261	81,551	Belgium-Luxembourg 58,814; Switzerland 21,195; West Germany 13,071.
Worked:				
Not specified	5,897	6,193	5,028	West Germany 2,913; Belgium-Luxembourg 1,264.
Slate, including crude	18,250	19,698	18,491	Netherlands 8,744; Belgium-Luxembourg 7,146.
Dolomite, chiefly refractory grade	29,010	58,127	46,523	Belgium-Luxembourg 30,036; West Germany 14,125.
Gravel and crushed stone. thousand tons	7,428	8,750	7,582	West Germany 6,169; Switzerland 1,167.
Limestone (except dimension)	155,290	135,861	92,404	Belgium-Luxembourg 89,199; Switzerland 43,445.
Quartz and quartzite	599	256	40	NA.
Sand, excluding metal-bearing. thousand tons	1,778	1,876	1,328	West Germany 659; Switzerland 522; Belgium-Luxembourg 354.
Sulfur, elemental do	893	1,035	287	United Kingdom 297; Netherlands 145; West Germany 87.
Talc and steatite	44,114	44,991	15,705	United Kingdom 10,002; United States 4,475.
Other:				
Nonmetals, n.e.s	119,674	180,082	22,149	Switzerland 157,623.
Slag, dross and similar waste, not metal-bearing from iron and steel manufactures. thousand tons	1,146	1,058	1,005	West Germany 958.
Oxides and hydroxides of magnesium, strontium, and barium.	6,975	8,108	1,030	U.S.S.R. 5,580; West Germany 465; Italy 369.
Fluorine	1	25	25	NA.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	23,982	17,289	82	United Kingdom 16,968.
Carbon black	46,431	44,185	15,152	Spain 8,665; Italy 5,097.

See footnotes at end of table.

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Table 4.—France: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total export		1967 destinations	
	1966	1967	EEC [1]	Principal destinations
MINERAL FULES AND RELATED MATERIALS—Continued				
Coal and briquets:				
Bituminous	697,637	707,118	660,560	West Germany 354,668; Belgium-Luxembourg 156,312; Netherlands 129,431.
Briquets of bituminous coal	20,566	15,635	9,741	Italy 9,691; Switzerland 5,791.
Lignite	77,334	83,825	-------	Spain 83,633.
Coke	109,929	117,864	60,030	Belgium-Luxembourg 24,754; Italy 16,288; Norway 14,495.
Gas, including liquid petroleum gases	427,260	488,535	56,829	Spain 270,394; Portugal 110,761; United Kingdom 86,816.
Hydrogen, helium and rare gases	2,777	5,120	5,120	All to Belgium-Luxembourg.
Peat, including briquets	442	937	894	West Germany 815.
Petroleum refinery products:				
Gasoline—thousand tons	2,105	2,740	1,009	United Kingdom 1,131; West Germany 508; Switzerland 348.
Kerosine and jet fuel—do	395	553	162	Switzerland 177; West Germany 90; United Kingdom 63.
Distillate fuel oil—do	4,340	2,990	1,753	West Germany 1,279.
Residual fuel oil—do	4,945	4,977	2,234	United Kingdom 1,516; West Germany 1,044; Belgium-Luxembourg 882.
Lubricants—do	275	308	96	United Kingdom 74; Algeria 37; Netherlands 37; Belgium-Luxembourg 38.
Chemical derivatives of coal, petroleum, or gas.	92,679	102,147	60,012	Netherlands 26,403; Belgium-Luxembourg 16,555; United States 12,900.

NA Not available.
[1] Belgium, West Germany, Italy, Luxembourg, and the Netherlands.
[2] Excludes artificial corundum.
[3] Including indium and thallium.
[4] Calculated from quantities reported in kilograms.
[5] Including cast iron and shot, grit, powder, and sponge of iron or steel.
[6] Including wire rod.
[7] Alkali, alkaline earth, and rare-earth metals except sodium.
[8] Including synthetic and reconstituted stone but not including diamond.
[9] Not including slate, flint, or industrial limestone.

Table 5.—France: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
METALS				
Aluminum:				
Bauxite	153,557	226,379	546	Australia 115,396; Greece 58,515; Guyana 33,859.
Oxide and hydroxide [2]	20,530	3,266	917	United States 1,574; West Germany 829.
Metal, including alloys:				
Scrap	7,121	5,954	5,339	Belgium-Luxembourg 4,321; Netherlands 568.
Ingots	87,268	98,774	5,037	Cameroon 43,083; Greece 22,517.
Semimanufacture	30,426	38,221	32,893	West Germany 16,514; Belgium-Luxembourg 12,774.
Antimony:				
Ore and concentrate	1,522	1,261	2	Morocco 548; Australia 254.
Metal, all forms	2,443	2,212	463	Mainland China 1,725; Belgium-Luxembourg 368.
Arsenic, oxides and acids	39	6	NA	NA.
Beryllium:				
Ore	408	2	-------	United Kingdom 1; United States 1.
Metal, all forms—value, thousands	$385	$97	$1	United Kingdom $58; United States $29.
Bismuth	749	806	85	United Kingdom 214; Peru 173; Japan 126.

See footnotes at end of table.

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Table 5.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
METALS—Continued				
Cadmium	549	505	179	Belgium-Luxembourg 111; Japan 91; United States 65.
Chromium:				
Ore	237,364	248,857	615	U.S.S.R. 96,877; Turkey 60,519; Iran 50,028.
Oxide and hydroxide	1,870	1,871	1,438	West Germany 1,393; United Kingdom 395.
Metal	4	69	6	United States 35; United Kingdom 28.
Cobalt:				
Ore	12,124	11,924	-------	All from Morocco.
Oxide and hydroxide	136	133	128	Belgium-Luxembourg 127.
Metal, all forms	437	398	255	Belgium-Luxembourg 233; United Kingdom 108.
Columbium:				
Ore (including tantalum ore)	429	382	-------	Canada 381.
Metal, all forms—value, thousands	NA	$26	$9	NA.
Copper:				
Matte	1,555	1,209	1,055	Belgium-Luxembourg 1,005.
Metal, including alloys:				
Scrap	18,719	11,495	7,262	West Germany 3,562; Belgium-Luxembourg 3,304.
Blister and other unrefined	6,886	11,609	8,426	Belgium-Luxembourg 8,406; Congo (Kinshasa) 3,158.
Refined	303,420	236,966	78,885	Belgium-Luxembourg 71,329; Zambia 44,715; Chile 44,688.
Semimanufactures	21,054	23,642	18,537	West Germany 9,306; Belgium-Luxembourg 6,146; Italy 1,916.
Germanium, gallium, etc. [3] value, thousands	$426	$323	$202	West Germany $116; Netherlands $54.
Gold: [4]				
Ashes and sweepings	troy ounces	87,643	700,499	651,566	West Germany 638,802.
Metal, including alloys	do	44,497	43,082	29,064	West Germany 18,583; United States 9,227; Switzerland 4,180.
Metal, other (temporary imports and reexports).	do	210,619	908,891	445,930	Switzerland 810,744.
Iron and steel:					
Ore and concentrate, except roasted pyrite.	thousand tons	4,245	4,845	50	Mauritania 1,644; Brazil 1,039; Liberia 954; Sweden 356.
Roasted pyrite	thousand tons	59	46	15	Spain 30; Italy 15.
Metal:					
Scrap	do	511	464	394	Belgium-Luxembourg 293; West Germany 71; United Kingdom 42.
Pig iron, spiegeleisen and other. [5]	do	159	174	122	Belgium-Luxembourg 41; West Germany 55; Netherlands 25.
Ferroalloys	do	49	73	22	New Caledonia 45; Belgium-Luxembourg 18.
Steel, primary forms	do	1,061	1,207	1,173	West Germany 597; Belgium-Luxembourg 501.
Semimanufactures:					
Bars, rods, sections. [6]	do	1,304	1,511	1,471	West Germany 759; Belgium-Luxembourg 582; Italy 110.
Universals, plates, sheets.	do	1,476	1,768	1,672	Belgium-Luxembourg 908; West Germany 581; Italy 97.
Hoop and strip	do	275	261	257	Belgium-Luxembourg 163; West Germany 88.
Rails and accessories.	do	35	43	10	United Kingdom 31; Belgium-Luxembourg 7.
Wire	do	65	77	71	West Germany 48; Belgium-Luxembourg 19.
Tubes, pipes, fittings.	do	187	245	216	West Germany 125; Belgium-Luxembourg 40; Italy 38.
Castings and forgings, rough.		2,587	3,043	2,598	West Germany 1,712; Belgium-Luxembourg 783.
Lead:					
Ore and concentrate		121,017	128,458	5	Morocco 43,968; Ireland 32,719; Australia 20,739.
Oxides		1,506	1,458	1,300	Belgium-Luxembourg 626; West Germany 605.
Metals, including alloys:					
Scrap		4,150	4,514	3,708	Belgium-Luxembourg 2,245; West Germany 1,450.

See footnotes at end of table.

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Table 5.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
METALS—Continued				
Lead—Continued				
Metals, including alloys — Continued				
Unwrought	35,899	39,605	17,840	Morocco 17,280; Belgium-Luxembourg 10,352; West Germany 7,198.
Semimanufactures	696	749	665	Belgium-Luxembourg 494; West Germany 161.
Magnesium, including alloys:				
Scrap	95	158	152	Italy 152.
Unwrought	951	986	250	Canada 327; Italy 247.
Semimanufactures	219	194	87	United Kingdom 77; Canada 33.
Manganese:				
Ore and concentrate	842,082	689,827	1,960	Republic of South Africa 249,247; Gabon 147,588; Morocco 125,259.
Oxide	2,159	2,316	1,565	Belgium-Luxembourg 1,435; Japan 730.
Metal, all forms	556	676	-------	Republic of South Africa 589; Japan 87.
Mercury, all forms---76-pound flasks	8,410	9,718	1,857	Spain 4,641; Italy 1,770; Mexico 1,305; United States 1,218.
Molybdenum:				
Ore and concentrate	5,665	5,436	407	United States 2,298; Canada 1,657.
Oxide	NA	8	7	West Germany 6.
Metal, all forms	86	82	62	West Germany 33; Netherlands 28; Austria 18.
Nickel:				
Matte	13,172	18,614	-------	Cuba 9,233; New Caledonia 8,442.
Oxide and hydroxide	33	98	26	Canada 40; United Kingdom 25; West Germany 22.
Metal, including alloys:				
Scrap	588	382	192	United States 124; Netherlands 74.
Unwrought	8,559	8,352	71	United Kingdom 4,497; Canada 2,929.
Semimanufactures	2,651	2,847	705	United Kingdom 1,044; West Germany 655; United States 439.
Platinum and platinum group: [4]				
Ashes and sweepings_troy ounces	17,522	37,423	22,152	Netherlands 16,140; Spain 8,841; West Germany 4,855.
Metals_____do____	161,461	160,914	45,429	United Kingdom 45,879; Netherlands 21,541; Czechoslovakia 21,253; West Germany 20,030.
Selenium	42	28	13	Sweden 9; West Germany 7; Belgium-Luxembourg 6.
Silver:				
Ashes and sweepings. thousand troy ounces	503	433	414	Netherlands 316; West Germany 64.
Metal, all forms_____do____	29,756	20,871	3,354	United States 8,231; United Kingdom 3,534; Belgium-Luxembourg 1,428.
Tantalum, all forms	12	11	6	United States 4; West Germany 4; Belgium-Luxembourg 2.
Thorium ore (monazite)	1,398	1,133	-------	Australia 506; Malagasy 475.
Tin:				
Oxide_____long tons	47	59	59	Belgium-Luxembourg 38; West Germany 21.
Metal, including alloys:				
Scrap_____do____	38	31	20	Belgium-Luxembourg 20.
Ingots_____do____	10,544	10,216	3,742	Netherlands 2,474; Malaysia 2,077; United Kingdom 1,245.
Semimanufactures_____do____	42	38	13	United Kingdom 20.
Titanium:				
Ore	110,516	99,257	-------	Australia 90,591.
Oxide	17,307	14,328	13,526	West Germany 9,122; Belgium-Luxembourg 2,112.
Metal, all forms	337	495	167	West Germany 167; Japan 143.
Tungsten:				
Ore	2,468	1,972	-------	Mainland China 649; South Korea 628.
Trioxide	57	8	8	All from West Germany.
Metal, all forms	74	78	59	West Germany 46.
Uranium:				
Ore	1,741	1,945	-------	Gabon 1,400.
Metal, including alloys_kilograms	NA	NA	-------	
Other radioactive materials_do____	267,000	NA	-------	

See footnotes at end of table.

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Table 5.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
METALS—Continued				
Zinc:				
Ore and concentrate	348,258	332,140	39,149	Canada 90,286; Morocco 50,316; Peru 38,618; Ireland 23,056.
Oxide	1,252	1,438	1,133	West Germany 788; Italy 310.
Metal, including alloys, all forms:				
Scrap	18,728	15,108	14,487	Netherlands 7,997; Belgium-Luxembourg 5,883.
Blue powder	4,224	4,153	3,966	Belgium-Luxembourg 3,966.
Unwrought	24,594	34,048	15,625	Belgium-Luxembourg 14,109; Bulgaria 4,625; Norway 4,227.
Semimanufactures	3,814	4,947	3,832	Belgium-Luxembourg 2,549; West Germany 1,270.
Zirconium:				
Ore	27,882	17,901	6	Australia 17,619.
Oxide	578	785	6	United States 673.
Metal	13	43	37	West Germany 37.
Other:				
Ores and concentrates	16,873	12,083	5	South Africa 3,651; Canada 3,146; Turkey 1,497; Australia 1,271.
Ashes and residues containing nonferrous metals:				
Aluminum	9,372	2,195	2,120	West Germany 1,774.
Copper	494	798	303	Brazil 495; West Germany 270.
Lead	753	807	43	Spain 400; Morocco 252.
Nickel	26	6	6	NA.
Zinc	6,957	13,105	9,911	West Germany 5,713; Belgium-Luxembourg 3,575.
Other	2,679	846	462	Morocco 190; West German 170; Italy 134.
Metals, including alloys, all forms [7]	94,172	76,616	76,616	West Germany 42,785; Belgium-Luxembourg 32,661.
NONMETALS				
Abrasive:				
Emery, natural corundum, other	3,843	1,386	801	Greece 383; Netherlands 370; United States 159.
Pumice	37,599	33,700	33,179	Italy 25,354; West Germany 7,544.
Dust and powder of precious and semi-precious stones. value, thousands	$3,608	$3,393	$839	United States $1,156; United Kingdom $1,041; Netherlands $551.
Grinding and polishing wheels	4,153	4,348	2,828	Belgium-Luxembourg 830; West Germany 737; Italy 695.
Asbestos	124,442	126,743	8,302	Canada 66,368; U.S.S.R. 30,090; Republic of South Africa 12,436.
Barite and witherite	82,938	88,688	67,530	West Germany 66,150; Morocco 12,626.
Boron materials:				
Crude natural borates	73,181	82,910	429	Turkey 45,233; United States 37,147.
Oxide and acid	827	606	519	Italy 513.
Bromine value, thousands	$4	$16	$16	NA.
Cement	87,842	42,755	22,533	Switzerland 19,441; Italy 17,706; West Germany 4,302.
Chalk	8,813	7,442	7,302	Belgium-Luxembourg 7,301.
Clay and clay products:				
Crude:				
Kaolin, including calcined	239,852	228,659	7,879	United Kingdom 197,723.
Bentonite	112,769	127,857	27,215	Greece 63,398; Italy 22,421.
Refractory clays	171,206	148,708	132,122	West Germany 114,808.
Clay and refractory construction materials (bricks, etc.).	32,227	34,698	19,110	United Kingdom 10,452, West Germany 8,626; Belgium-Luxembourg 6,341.
Cryolite and chiolite, natural	1,984	1,431	-------	All from Denmark.
Diamond:				
Industrial, except dust. value, thousands	$5,075	$5,146	$1,852	Ireland $2,257; Belgium-Luxembourg $1,097; United Kingdom $718; Netherlands $714.
Gem, unset do	$20,654	$19,593	$9,328	Belgium-Luxembourg $7,692; Israel $3,702; Republic of South Africa $2,517.
Diatomite	9,132	7,106	1,889	United States 2,401; Algeria 2,034; West Germany 1,356.
Feldspar	15,523	11,946	4,702	West Germany 3,993; Norway 2,185; Portugal 1,932.

See footnotes at end of table.

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Table 5.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
NONMETALS—Continued				
Fertilizer materials:				
Crude:				
Nitrogenous (natural sodium nitrate).	29,782	22,962	20	Chile 22,942.
Phosphate thousand tons rock.	2,939	3,110	12	Morocco 1,823; Tunisia 563; Togo 382.
Potassic salts, crude	NA	-------	-------	
Manufactured:				
Ammonia, anhydrous	52,471	61,638	61,633	Belgium-Luxembourg 56,996.
Nitrogenous	151,516	139,108	133,369	Belgium-Luxembourg 102,602; West Germany 21,617.
Potassic	62,017	95,668	59,531	Belgium-Luxembourg 44,283; Spain 36,128.
Phosphatic:				
Basic slag	682,725	744,537	744,537	Belgium-Luxembourg 630,130; West Germany 114,407.
Other	300,844	324,135	247,150	Netherlands 136,877; Belgium-Luxembourg 110,032; Tunisia 38,639.
Flint (pebbles)	101,080	178,732	8,755	NA.
Fluorspar	3,109	3,476	926	Spain 2,000; West Germany 886.
Graphite	4,879	4,882	1,501	Malagasy Republic 2,822; Italy 1,023; West Germany 45.
Gypsum and plaster	23,095	21,348	21,242	West Germany 17,507.
Iodine, crude	-------	362	-------	Japan 324.
Lime	99,756	118,454	117,192	Belgium-Luxembourg 91,815; West Germany 17,507.
Lithium and strontium minerals	4,742	2,570	2,539	Netherlands 2,819.
Magnesite, including calcined	42,154	39,620	2,770	Austria 19,039; United Kingdom 5,065.
Mica	7,548	3,652	12	Norway 1,409; India 994.
Pigments:				
Earth pigments, including iron oxide.	15,491	13,888	12,525	West Germany 12,264.
Earths, other (pozzolanic, santorin, etc.).	332	405	120	Spain 285.
Precious and semi- value, thousands precious stones.[8]	$8,120	$9,456	$542	India $4,612; Brazil $1,480.
Pyrite	338,984	315,816	1,262	Cyprus 142,279; Spain 126,442.
Salt	58,060	51,460	22,102	Algeria 28,990; Netherlands 12,924.
Sodium and potassium salts, n.e.s.:				
Caustic soda	31,597	33,686	33,474	Italy 25,994; Belgium-Luxembourg 4,433.
Caustic potash and peroxides of potassium or sodium.	109	110	37	Sweden 67.
Stone, sand and gravel:[9]				
Dimension stone:				
Crude and partly worked:				
Slate	-------	2,089	1,916	Italy 860; West Germany 750.
Other	-------	190,387	108,553	Italy 74,430; Republic of South Africa 43,648; West Germany 23,559.
Worked:				
Slate	21,585	26,977	3,672	Spain 15,446; Italy 2,842.
Other	75,019	79,308	65,342	Italy 62,278; Portugal 10,860.
Dolomite, chiefly refractory grade	183,323	172,907	164,875	Belgium-Luxembourg 152,737; West Germany 12,015; Norway 7,704.
Gravel and thousand tons crushed stone.	2,531	3,288	3,277	Belgium-Luxembourg 3,175.
Limestone	159,631	145,054	145,054	Belgium-Luxembourg 139,984.
Quartz and quartzite	21,667	21,369	19,472	Belgium-Luxembourg 9,664; Italy 8,280.
Sand, excluding thousand tons metal-bearing.	1,408	1,643	1,585	Netherlands 870; Belgium-Luxembourg 551.
Sulfur, elemental, all grades	226,461	235,100	1,826	Mexico 217,789; United States 13,067.
Talc and steatite	7,670	8,659	5,451	Italy 3,709; Austria 1,490; Belgium-Luxembourg 1,346.
Other nonmetals, n.e.s.	525,349	528,743	19,860	Switzerland 502,354.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural	3,100	2,317	82	United States 1,637.
Carbon black	39,654	47,754	28,925	Netherlands 21,208; United States 15,305; West Germany 6,538.

See footnotes at end of table.

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Table 5.—France: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	Total import		1967 sources	
	1966	1967	EEC [1]	Principal sources
MINERAL FULES AND RELATED MATERIALS—Continued				
Coal and briquets:				
Coal—thousand tons	11,092	11,445	6,521	West Germany 5,658; United States 2,176; U.S.S.R. 1,478.
Coal briquets—do	333	324	319	Netherlands 192; Belgium-Luxembourg 84.
Lignite and lignite briquets—do	368	357	357	West Germany 351.
Coke—do	3,734	3,326	3,326	West Germany 2,664; Netherlands 437.
Gas, hydrocarbon:				
Natural	402,332	627,816	249,879	Algeria 346,310; Netherlands 149,902; West Germany 46,563.
Manufactured	118,815	118,068	118,068	West Germany 79,870; Belgium-Luxembourg 36,236.
Hydrogen and rare gases	517	692	601	West Germany 587.
Peat, including briquets. thousand tons	27	30	27	West Germany 19; Netherlands 8.
Petroleum:				
Crude—do	62,752	72,348	-------	Algeria 21,600; Iraq 13,576; Kuwait 8,895; Libya 8,729.
Refinery products:				
Gasoline—do	589	568	265	Italy 201; Rumania 100; U.S.S.R. 69; Netherlands Antilles 63.
Kerosine—do	81	81	9	United Kingdom 17; Belgium-Luxembourg 5.
Distillate fuel oil—do	2,440	2,675	1,438	Italy 1,219; U.S.S.R. 663; Rumania 494.
Residual fuel oil—do	1,117	1,118	501	U.S.S.R. 350; Italy 346; Rumania 214.
Lubricants—do	51	85	22	Netherlands 9; Italy 7; United States 6.
Other—do	505	494	256	West Germany 172; United States 118; United Kingdom 45; U.S.S.R. 41.
Mineral tar and crude chemicals derived from coal, petroleum, or gas.	282,719	310,270	139,270	United States 104,801; Netherlands 54,560; United Kingdom 39,359; Italy 30,246.

NA Not available.
[1] Belgium, West Germany, Italy, Luxembourg, and the Netherlands.
[2] Excludes artificial corundum.
[3] Includes gallium, germanium, indium, thallium, rhenium.
[4] Calculated from quantities reported in kilograms.
[5] Includes cast iron and sponge, powder, etc., of iron and steel.
[6] Including wire rod.
[7] Alkali, alkaline earth, and rare-earth metals including cerium and hafnium.
[8] Including synthetic and reconstituted stone but not including diamond.
[9] Excludes flint and industrial limestone.

COMMODITY REVIEW

METALS

Bauxite and Aluminum.—Bauxite output remained on the same level as in 1967. Although the disturbances in May and June interrupted aluminum production, the upward trend in the second half of 1968 increased the years output by 1 percent. Bauxite shipments in 1967 to end users was as follows, in metric tons: for alumina, 2,532,510; cement, 72,932; abrasives, 21,909; chemical industry, 13,754; refractory products, 2,050; and for resale and exports, 217,662.

The supply position of aluminum in 1968 was as follows in thousand metric tons:

Production of primary aluminum	366
Production of secondary aluminum	74
Imports of aluminum (ingots)	98
Exports of aluminum (ingots)	187
Total available	351
Reported consumption	335

Secondary aluminum is produced by about 30 different companies, the largest of which is the Affifrance of the Groupe Pechiney with four plants and a combined output of 28,000 tons of secondary aluminum per year.

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Principal aluminum consumers and their percentage shares of total consumption were as follows: transportation 33, electric industry 14; construction 9; machinery and equipment 8; consumer durables 7; and others 20.

Of the aluminum ingot produced about half is made into semimanufactures; for Pechiney, the largest producer, the figure is 65 percent. Independent semimanufacturers account for 35 percent of the wire and cable market, 10 to 12 percent share the market for rolled and extruded aluminum and aluminum castings.[4]

Copper.—Primary refined copper consumption was 292,900 tons. Consumers and their shares in total consumption were similar to those in 1967. Direct use of copper scrap in the latter year amounted to 122,800 tons.

Copper imports in 1968, valued at $379 million, comprised 332 tons of matte, 14,813 tons of scrap, 16,416 tons of blister, 259,948 tons of refined copper, and 28,141 tons of semimanufactures. French copper exports valued at $108 million, comprised 621 tons of matte, 33,301 tons of scrap, 12,687 tons of blister, 12,732 tons of refined copper, and 32,966 tons of semimanufactures.

Production of semifinished copper and copper alloys (wire, rods and sections, plates, sheets and strips, and tubes) totaled 398,274 tons (383,893 tons in 1967).

Iron Ore.—Iron ore production increased 12.4 percent over that in 1967, reaching the 1966 level. The average grade of ore was 32.2 percent, moderately higher than in 1967. In the Lorraine mines, production per man-shift (surface and underground) increased to 25 tons from 21 tons in 1967. Iron ore shipments to domestic steel plants totaled about 37 million tons and yearend stocks 5,715,000 tons.

France exported 18,271,234 tons of iron ore in 1968 to its traditional customers. Imports of iron ore increased to 5,016,749 valued at $48 million.

Iron and Steel.—*Production.*—In 1968, French pig iron and crude steel production, 16,450,000 tons and 20,410,000 tons respectively, rose by 4 and 5 percent respectively over the 1967 levels. For the first time French crude steel output surpassed 20 million tons, but the strikes caused a loss of 1 to 1.5 million tons. Crude steel production capacity is estimated to have attained 24.3 million tons per year and 25-million-ton annual capacity is expected by 1970. The share of oxygen steel, 18 percent of total output, was still below the European Economic Community's average of about 32 percent. France produced about 4 percent of world's total steel output and maintained its position as the sixth largest world producer.

Trends which have been reported previously continued during 1968, as reflected

[4] Metals Week. V. 39, No. 38, Sept. 16, 1968, p. 154 A.

Table 6.—France: Marketable iron ore production by basin, and total iron ore shipments and stocks

(Thousand metric tons)

	1964	1965	1966	1967	1968 p
PRODUCTION					
Lorraine	57,455	56,125	51,684	46,000	52,300
West (Normandy and Anjou)	3,400	3,326	3,308	3,200	3,000
Pyrénées	65	80	58	40	1
Other basins	18				
Total	60,938	[1] 59,532	55,050	[1] 49,240	55,300
Iron content	18,440	18,098	17,114	15,651	17,400
SHIPMENTS					
Domestic	38,689	38,145	36,335	34,499	37,406
Other EEC countries	21,882	20,672	18,375	17,223	18,440
Other destinations	227	88	63	83	27
Total	60,798	58,905	54,773	51,805	55,852
Stocks	7,700	8,238	8,300	r 6,067	5,715

NA Not available.
[1] Data do not add to totals shown because of independent rounding.

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Table 7.—France: Salient iron and steel industry statistics

(Thousand metric tons unless otherwise specified)

	1964	1965	1966	1967	1968
SINTER					
Production	17,442	18,531	19,436	21,065	22,796
Raw material consumption:					
Iron ore	20,780	22,454	23,484	25,433	27,259
Furnace dusts	1,476	1,241	1,273	1,007	1,016
Manganese	48	64	54	30	10
Pyrite cinder	58	34	38	26	23
Other iron-bearing materials	549	591	580	685	977
Limestone	404	552	587	702	690
PIG IRON					
Number of blast furnaces:					
Available	138	133	127	124	109
In operation at yearend	98	94	84	83	74
Maximum production capacity	18,100	18,770	19,100	19,650	19,540
Production:					
Thomas [1]	13,042	12,559	12,245	12,085	12,686
Hematite and semihematite (steelmaking)	1,300	1,680	1,983	2,359	2,506
Phosphorus (foundry)	452	416	282	207	188
Hematite and semihematite (foundry)	450	509	552	625	581
Special pig iron (foundry)	205	174	174	115	115
Spiegeleisen and high-carbon ferromanganese	412	432	355	320	374
Total [2]	15,863	15,770	15,590	15,710	16,450
Raw material consumption for pig iron production:					
Iron ore directly in blast furnaces	21,246	19,398	16,968	r 16,968	14,323
Iron ore sinter	17,328	18,337	19,340	21,064	22,531
Manganese ore:					
In blast furnaces	630	677	605	562	687
In sintering plants	48	70	55	30	10
Metallurgical rejects	1,175	1,068	1,182	931	963
Scrap	690	478	433	426	315
Limestone	312	293	270	231	97
Phosphatic limestone	1	1	2	1	1
Coke in blast furnaces	12,785	12,325	11,584	10,931	11,261
STEEL					
Number of furnaces in operation:					
Thomas converters	95	94	92	89	92
Open hearth	62	54	53	52	51
Electric	109	109	112	112	107
Oxygen	8	9	10	9	10
Maximum production capacity (all furnaces)	21,900	22,500	23,400	23,900	24,340
Production of crude steel:					
Thomas	10,604	10,397	10,301	10,112	10,507
Open hearth	5,182	4,775	4,483	4,284	4,072
Electric	1,675	1,774	1,863	1,905	2,068
Bessemer	93	88	67	67	57
Kaldo, LD, and similar	2,224	2,568	2,871	3,287	3,705
Creuset	2	2	1	----	----
Total	19,780	19,604	19,585	19,655	20,409
Ingots	19,413	19,237	19,247	r 19,309	20,025
Liquid steel for casting	367	367	338	346	385
Material consumption for steel:					
Pig iron, spiegeleisen, and ferroalloy	14,703	14,633	14,611	14,796	15,646
Scrap	7,012	6,884	6,909	6,826	6,787
Liquid Thomas steel	193	173	147	129	158
Lime	1,933	1,892	1,890	1,831	1,915
Limestone	60	51	47	r 114	102
Iron ore	188	210	213	207	258
Fluorspar	37	32	33	33	NA
Consumption per ton of crude steel:					
Pig iron kilograms	737	740	739	740	767
Scrap do	359	364	366	364	333
Rolled steel production:					
Rails and accessories	353	364	259	283	302
Heavy structural	1,030	1,122	1,121	1,143	1,209
Wire rods	2,010	2,085	2,153	2,106	2,353
Bars	3,327	3,480	3,297	3,333	3,518

See footnotes at end of table.

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Table 7.—France: Salient iron and steel industry statistics—Continued

(Thousand metric tons unless otherwise specified)

	1964	1965	1966	1967	1968
STEEL—Continued					
Rolled steel production—Continued					
Pipe skelp	602	609	601	558	589
Other	37	31	22	18	16
Flat products:					
Wide plates	79	94	94	96	104
Hot rolled sheets:					
Thickness, 4.76 millimeters or more	1,199	1,160	1,206	1,354	1,369
Thickness, 3 to 4.76 millimeters	501	500	512	514	488
Thickness, less than 3 millimeters	742	726	731	600	482
Cold rolled sheets: Thickness, less than 3 millimeters	3,647	3,579	3,794	3,825	4,205
Hot-rolled strips for tubes	1,092	1,043	1,084	1,017	1,076
Subtotal flat products [2]	7,260	7,101	7,419	7,406	7,723
Total rolled steel production [2]	14,619	14,793	14,873	14,847	15,711
Galvanized and other plated sheets	506	447	493	522	516
Condenser sheets	207	188	187	178	168
Tinplate	625	543	659	691	662
Total consumption of iron and steel industry:					
Iron ore	42,214	42,062	40,664	r 46,664	41,840
Scrap [3]	7,701	7,362	7,342	7,253	7,101
Coke	14,327	13,778	12,835	12,145	12,370
Coal other than coking coal	1,412	1,608	1,750	1,935	1,931
Coking coal	5,712	5,627	5,530	5,502	5,543
Fuel oil	r 1,295	r 1,290	r 1,360	r 1,510	1,576
Thomas slag production	2,573	2,546	2,560	2,517	2,677
Average total employment (workers and staff)	130,806	127,593	120,560	114,102	108,647

r Revised.
[1] Includes special pig iron in metric tons as follows: 1963, 6,137; 1964, 42,994; 1965, 8,749; 1966, 2,729.
[2] Detail does not add to total because of rounding.
[3] Excludes scrap used by rolling mills in tons as follows: 1963, 77,866; 1964, 85,858; 1965, 98,284; 1966, 93,818; 1967, 108,080; 1968, 107,644.

in the salient statistics of the industry. However, the increase in steel output in the north (36,656 tons) was much less than that during the previous year (216,971 tons). Eastern France accounted for 72 percent of the pig iron and 63 percent of the crude steel output; corresponding figures for the north were 24 and 27 percent, respectively.

Rolled steel output increased 5.8 percent. All classes of products increased except medium sheets and hot rolled thin sheets. The 49 percent share of flat products in rolled steel output, was almost the same as in 1967. Hot-rolled sheet's decline of 117,000 tons (about 4.7 percent) was compensated for by an increase in cold-rolled thin sheets, 182,000 tons (about 4.8 percent). Production of all classes of coated sheets as well as transformer sheets declined.

Consumption.—In terms of crude steel, apparent consumption (without regard to stock changes) increased 11 percent to 18.5 million tons. Index of passenger cars produced increased to 122 from 119 in 1967 (1965=100), but the index for commercial vehicle output declined from 91 to 85. Domestic shipments of crude steel in 1967 totaled 10,548,000 tons distributed as follows in thousand tons; For conversion 2,735; to steel merchants 2,938; to manufacturing industries 2,741; to railroads, extractive industries, and building industry 1,112; others 174; and alloy steels [5] 848.

Trade.—French emergency trade measures, announced in June to deal with balance of payment problems, imposed global import quotas for a period of 6 months starting July 1 on a number of goods including iron and steel. The quota permitted steel imports to increase by 7 percent more than over the same period the year before.

France exported 6,652,324 tons of steel ingots and other primary forms and semimanufactures (including pipes and tubes). Corresponding import figures were

[5] Organization for Economic Cooperation and Development. The Iron and Steel Industry in 1967 and Trends in 1968. Paris, France, 1968, table 26.

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4,820,313 tons. Trade in pig iron and similar products, except ferroalloys, comprised 71,511 tons of exports and 245,254 tons of imports. Net steel exports of 1,832,000 tons were 383,000 tons more than in 1967. European Economic Community countries received about 45 and 75 percent, respectively, of total exports of steel and pig iron. The corresponding figures for imports were 95 and 83 percent, respectively. The largest class of imports were ingots and coils for rerolling (1,245,000 tons) and uncoated sheets (1,400,000 tons). Wire rods and bars each accounted for 17 percent of exports and sheets for 27 percent.

Industry Developments.—Implementation of the Plan Professionel de la Sidérurgie which was started in 1967, continued in 1968. Investment in 1968 may have been in excess of $250 million compared with $192 million in 1967, which showed a 24-percent increase relative to 1966. During 1967–68 emphasis was placed on rationalization of production and rationalization agreements pertaining to blast furnace and steel mill operation, and construction of joint steelmaking plants. As a result about a dozen plants have been closed and old facilities retired in existing plants, without capacity loss. The decision to build a coastal iron and steel plant in the Marseille area was reported at yearend.

In the Dunkirk plant of the Union Sidérurgique du Nord de la France (USINOR), blast furnace plant No. 3 was put in operation. Blast furnaces 1 and 2 will be rebuilt with large diameters (9.5 instead of 8.5 meters). In the Joeuf plant of De Wendel-Sidélor, a new sinter plant was inaugurated. The plant equipped with a strand, of 72 meters long and 4 meters wide, is designed to produce 170,000 to 200,000 tons of sinter per month. The sinter is fed into the two modernized blast furnaces.

With some 17 tube plants, having a total yearly production of almost 1 million tons, Vallourec has a near monopoly in production of seamless tubes. As part of the rationalization moves, Sidélor sold its seamless tube plant at Devilles-les-Rouen to Vallourec. Vallourec was reportedly taking over the 51 percent capital which Sidélor owns in Compagnie Industrielle et Commerciale des Tubes.[6]

The Pompey special steel plant was taken over by a consortium consisting of all special steel producers of France and the Saar group, Roechling, which formed a new company, Société Nouvelle des Acièries de Pompey. The participating French companies were Ugine-Kuhlman, Compagnie des Ateliers et Forges de la Loire (CAFL), Société des Forges et Ateliers du Creusot (SAFC, a subsidiary of the Schneider group), Chatillon-Commentry, Neuves-Maisonos, and Haut Fourneaux de la Chiers.[7] As part of the Pompey agreement, a new unit for producing special steels (100,000 tons annual capacity) will be built with government financial assistance, at Isbergues (Pas de Calais). Capacity at the Pompey plant will be increased from 500,000 to 600,000 tons per year of alloy and special steels. The grades and sizes of the output of the two plants will be harmonized with the plants of the various owners to insure that Pompey's output will not compete with those of the parent companies.[8]

CAFL and SFAC, mentioned above, have also rationalized their production. Tool steels are no longer made by SFAC but by CAFL - Bedel group. The heavy plate mill at CAFL's Ordaine works was closed down and production transferred to SFAC. CAFL's Les Dunes works now produce hooks and tires for both.[9]

Ferroalloys.—Electric furnace ferroalloy output totaled about 280,000 tons (267,000 tons in 1967) of which ferrosilicon accounted for 132,000 tons, silico spiegel (25 percent silicon and 70 percent manganese) 8,800 tons, and ferrochrome (65 to 70 percent chromium) 87,000 tons.

In 1968 France exported 290,000 tons of ferroalloys (blast furnace as well as electric furnace ferroalloys) and imported 80,000 tons of the same.

Lead and Zinc.—Production of both metals increased, 1 percent for lead and 11.5 percent for zinc. The increase in zinc output may have resulted from planned increased output in the Noyelles-Godault plant.

Refined lead and slab zinc consumption in 1968 totaled 164,200 and 202,300 tons,

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[6] Metal Bulletin. No. 5294, Apr. 30, 1968, p. 14.
[7] The Iron Age. V. 202, No. 10, Sept. 5, 1968, p. 25.
[8] Metal Bulletin. No. 5339, Oct. 11, 1968, p. 17.
[9] Metal Bulletin. No. 5272, Feb. 9, 1968, p. 15.

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respectively, almost the same as in 1967 for zinc and 4,400 tons less for lead.[10]

Trade in lead and zinc in 1968 were as follows:

Form	Metric tons	
	Imports	Exports
LEAD		
Ore and concentrate	128,384	3,612
Scrap	3,284	10,535
Metal (pig lead and alloys)	47,044	16,774
Semimanufactures	850	1,618
ZINC		
Ore and concentrate	361,884	27,231
Scrap	19,193	2,410
Zinc dust	3,048	1,295
Metal (slab zinc and alloys)	31,081	20,609
Semimanufactures	8,297	3,899

Value of the listed imports and exports for lead totaled $36 million and $1 million, respectively. Imports of ore and concentrates were almost the same as in 1967 but lead metal imports declined.

Value of the listed imports and exports of zinc totaled $42.5 million and $8 million, respectively. Increased ore imports (about 29,000 tons) was partially compensated by 3,000-ton decline in imports of slab zinc. Export of slab zinc also showed an 8,000-ton increase.

Peñarroya and Preussag of West Germany formed a joint company to coordinate future lead-zinc ventures, both within and outside the European Economic Community, covering marketing, production, and exploration.

Nickel.—Le Nickel produced 10,295 tons of nickel at its Le Havre refinery. In this plant nickel matte received from New Caledonia is roasted to eliminate the sulfur and produce an oxide. The oxide is agglomerated and then reduced in vertical retorts, the product being in form of pellets.

Tin.—Tin consumption in 1968 was estimated at 9,596 long tons, (9,350 tons primary and 246 tons secondary) distributed approximately as follows, in percent: Tinplating 55.3, white metal alloys 28.3, copper alloys 7.7, chemical products 4.2, semimanufactures 2.8, and miscellaneous 1.7.[11]

The decline in tin consumption noted in 1967 (250 long tons less than in 1966) continued in 1968, when 750 tons less tin was used. The decline resulted from fall in tinplate production from 690,503 tons in 1967 to 662,077 tons in 1968. Production of solder and antifriction metals increased to 8,770 and 1,550 tons, respectively.

France's tin trade in 1968 was as follows in long tons:

Commodity	Imports	Exports
Concentrate	73	587
Metal	9,384	122
Alloys	255	168
Semimanufactures	120	117
Scrap	111	17

Tin concentrate produced in France by Société des Mines de Saint-Renan is exported, mainly to Spain, because France has no tin smelting facilities.

Tungsten.—Ore reserves at Salu (Ariège), which has been under exploration by Bureau de Recherches Géologiques et Minières, have been estimated at 500,000 tons Scheelite assaying 1.45 percent tungsten trioxide (WO_3) and 0.3 percent copper. Tests have indicated that commercial concentrates (minimum grade of 65 percent WO_3) could be obtained at a recovery of at least 80 percent. Starting in 1970, this property should produce 800 to 1,000 tons of WO_3 in Scheelite per year.[12]

In 1968 France imported 1,603 tons of tungsten concentrate, 12 tons of tungsten powder, 16 tons of scrap, and 27 tons of semimanufactures. It also exported 145 tons of tungsten metal (powder), 180 tons of scrap, and 27 tons of semimanufactures.

Uranium.—The French Atomic Energy Commission (CEA) announced the discovery of a uranium deposit at La Couraillère. Further details are lacking. The latest estimate of French uranium reserves given by CEA amounts to 50,000 tons of U_3O_8 of which 30,000 represent measured reserves.[13]

Current production of domestic uranium ore is at a level of about 1,100 tons of uranium content and concentrating capacity is equivalent to 2,000 short tons of U_3O_8. It is not planned to increase domestic ore production beyond this level.[14]

[10] World Bureau of Metal Statistics (London). World Metal Statistics. April 1969, pp. 41, 49.
[11] Dieppedalle & Sealles. Statistique Etain (Tin statistics), 1968. Paris, France, Apr. 4, 1969, 3 p.
[12] World Mining. V. 5, No. 2, February 1969, p. 33.
[13] The South African Mining and Engineering Journal. V. 80, Part 1, No. 71, Mar. 14, 1969, p. 555.
[14] Organization for Economic Cooperation and Development. Uranium. Production and Short Term Demand. Paris, January 1969, p. 9.

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Pechiney and Mokta decided to unite their operations for prospecting and exploiting uranium and copper. For this purpose, they formed the Société Minière Péchiney-Mokta.

NONMETALS

Preliminary data indicate that the output of alluvial sand and gravel and road-building materials, the most important nonmetals produced in terms of value, increased 26 and 18 percent, respectively. Industrial sand output also increased modestly.

In 1967, the latest year for which data are available the value of crude nonmetals produced were as follows in million dollars:

Quarry products	571
Other nonmetals	188
Total nonmetals	759

Quarry products accounted for 33 percent of the value of all mineral output and 75 percent of all nonmetals. Among nonmetals other than quarry products, potash, salt, and sulfur were the most important items in value in the order given.

Cement.—At the end of 1967 France had 71 cement plants with individual yearly kiln capacities varying from a minimum of 70,000 to a maximum of 1,690,000 tons.[15] Production capacity at yearend was 33 million tons, 1.8 million tons more than at yearend 1967. The increase resulted from building a new plant with one kiln (700,000 tons annual capacity) and adding four kilns in existing plants. Of the latter, two were for replacement of older kilns.

Cement output by type in the 1963–67 period was as follows:

Type	Thousand metric tons				
	1963	1964	1965	1966	1967
Portland	12,647	16,227	16,844	18,031	19,232
Slag:					
Blast furnace	2,485	2,333	2,400	2,341	2,257
Other	1,448	1,144	1,239	1,211	1,407
Special	749	983	1,050	1,001	866
Total	17,329	20,687	[1] 21,534	22,584	[1] 23,763
Natural	275	255	213	81	104
Mortar	530	595	619	638	551
Grand total	18,134	21,537	[1] 22,365	[1] 23,304	[1] 24,418

[1] Data do not add to totals shown because of independent rounding.

Fertilizer Materials.—In terms of K_2O content potash production declined 5.5 percent. Domestic and overseas shipments were 1,099,000 and 600,000 tons respectively. Production by the Entreprise Minière et Chimique formed in 1967 by the merger of Mines Dominales de Potasse d'Alsace (MDPA) and Office National Industriel de l'Azote, is to be stabilized at 1.7 million tons of K_2O annually. Following this merger the link of the potash industry to other fertilizer industries is to be strengthened. Efforts are continuing to improve efficiency and meet international competition. For this purpose a $40 million investment program is envisaged to complete modernization and rationalization. Production will be concentrated in three divisions —Theodore, Amelie, and Marie-Louise and mining will cease at Bollwiller Rodolph and Anna Ferdinand. The Joseph mine was closed in 1966.

In contrast to potash fertilizers, production of synthetic nitrogenous fertilizers, phosphatic and mixed fertilizers increased. Details of phosphatic fertilizer output in 1967–68 were as follows in thousand metric tons of P_2O_5.[16]

Single superphosphate	227
Enriched superphosphate	72
Triple superphosphate	143
Basic slag	425
Mixed	388
Other	53
Total	1,308

France is fourth largest producer of phosphatic fertilizers in the world and first in West Europe, accounting for 25 percent of West Europe's output. The trend has been toward phosphoric acid-based fer-

[15] The European Cement Association. West European Cement Directory. Paris, pp. 7–12.
[16] Phosphorus and Potassium. No. 37, September–October 1968, p. 8.

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tilizers and, structurally, toward larger coastal plants.

Société Chimique des Charbonnages, a subsidiary of Charbonnages de France, has decided to build a superphosphate plant in the La Bassée at Douvrin. The $13 million plant will process 400,000 tons of phosphates and produce also mixed fertilizers. The company will also build a 200-ton-per-day phosphoric acid unit at the plant of the Finalens Company.

The 100-ton-per-day ammonia plant of L'Ammoniac Sarro-Lorraine, a joint subsidiary of Charbonnages de France and Saarbergwerke of West Germany, at Carling in the Moselle Area, started production and will reach full capacity progressively.

Produits et Engrais Chimiques du Rhin (PEC-Rhin), a joint subsidiary of MDPA and Wintershall A.G. of West Germany, signed a contract to build a 545-ton-per-day ammonia plant. PEC was to build a nitrogenous and compound fertilizer plant at Ottmarsheim near Mulhouse.

Trade in fertilizer materials in 1968 was as follows, in thousand metric tons:

Type	Imports	Exports
CRUDE		
Nitrogenous	25	9
Phosphate rock	3,397	8
Potassic salts	-----	57
Organic	13	38
MANUFACTURED		
Ammonia, anhydrous	150	7
Nitrogenous	213	592
Potassic	271	945
Phosphatic:		
Basic slag	841	312
Other	361	51

Sulfur.—Production of both sulfur, recovered from the Lacq gasfield, and of pyrite declined. However, production of elemental sulfur should increase because the Société Nationale des Pétroles d' Aquitaine (SNPA) producer of Lacq natural gas, has ordered the construction of a 500-ton-per-day sulfur recovery unit for gas from Saint Faust gasfield which has 5.9 percent H_2S.[17] The price of Lacq sulfur was increased on May 1, from $37 to $41 per ton to bring it nearer to the world price level.

Texas Gulf Sulphur Co. and La Compagnie Francaise des Pétroles announced the creation of two jointly owned companies to explore for sulfur in the coastal waters off the African continent.

MINERAL FUELS

France's energy consumption in 1968 totaled 197 million tons (preliminary) of standard coal equivalent (SCE). Shares of different fuels and hydroelectricity in the last 5 years were as follows in millions metric tons SCE:

Year	1964	1965	1966	1967	1968
Solid fuels	74.3	68.5	64.7	63.8	62.5
Gas	8.3	8.5	9.0	10.0	9.9
Petroleum products	[1] 67.2	74.6	82.3	92.6	102.3
Electricity	15.0	19.3	22.4	20.0	21.9
Total	164.8	170.9	178.4	186.4	196.6

[1] Petroleum products used only for energy product.

The share of domestic solid fuels in total energy consumption in 1968 was 20 percent and that of domestic and imported solid fuels 32 percent. Share of domestic solid fuels in energy consumption is expected to be only 10 percent in 1975 when total energy consumption will reach 250 million tons SCE.

Coal.—*Production.*—Production of coal (anthracite and bituminous) continued to decline. The Nord/Pas-de-Calais accounted for about two-thirds of the total production loss; the remainder resulted from production loss in the Lorraine field. These two areas accounted for 47 and 33 percent of total output; corresponding 1967 figures were 49 and 32 percent. It is estimated that nearly half of the 5.7-million-ton loss in output was caused by the strikes in May.

[17] Sulphur (London). No. 76, May–June 1968, p. 7.

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Table 8.—France: Salient statistics of the coal and lignite industry

(Thousand metric tons unless otherwise specified)

	1963	1964	1965	1966	1967	1968
COAL						
Production:						
Anthracite	3,053	3,373	3,621	3,541	2,880	NA
Semianthracite	7,869	8,912	8,798	9,140	9,152	NA
Bituminous:						
Low volatile [1]	5,249	5,247	4,378	4,034	3,715	NA
Medium-volatile [2]	12,392	13,317	12,941	13,140	12,415	NA
High-volatile [3]	16,686	19,117	18,465	17,527	16,561	NA
High-volatile [4]	2,504	3,064	3,115	2,955	2,901	NA
Total [5]	47,762	[e] 58,030	51,348	50,338	47,625	41,911
Apparent consumption (including lignite) thousand tons of standard coal equivalent	77,100	74,400	69,100	64,200	63,700	NA
Stocks at yearend	6,123	5,703	7,402	10,476	11,723	10,507
Number of operating mines	NA	77	70	67	[e] 63	NA
Average number of days worked	256	278	274	275	260	247
Average daily output, metric tons	186,500	190,400	187,000	183,400	183,300	169,900
Number of men working daily at yearend:						
Underground, persons	115,090	110,900	107,694	102,959	94,292	83,776
Surface, do.	46,795	44,951	43,352	41,504	39,679	38,259
In associate plants, do.	9,894	9,307	8,937	8,921	8,625	5,145
Production per man-shift:						
Nord/Pas-de-Calais:						
Underground, kilograms	1,663	1,709	1,661	1,707	1,805	1,842
Underground and surface, do.	1,149	1,191	1,167	1,205	1,252	1,245
Lorraine:						
Underground, do.	2,903	3,113	3,239	3,453	3,703	3,888
Underground and surface, do.	1,902	2,078	2,146	2,277	2,443	2,483
All of France:						
Underground, do.	1,958	2,046	2,038	2,104	2,241	2,347
Underground and surface, do.	1,332	1,411	1,397	1,446	1,523	1,555
Power production by pithead steam plants:						
Quantity, million kilowatt-hours	10,931	14,762	12,146	10,233	11,812	NA
Share of thermal power produced in France, percent	24.4	25.0	22.1	18.8	17.7	NA
Share of total power produced in France, percent	12.4	15.7	12.0	9.6	10.6	NA
LIGNITE						
Production	2,471	2,244	2,690	2,564	2,931	3,221
Stock at yearend	485	456	452	520	379	233
Average number of days worked	256	259	274	274	260	247
Average daily output, metric tons	9,700	8,600	9,800	9,300	10,400	11,700
Number of men working at yearend:						
Underground, persons	1,853	1,780	1,662	1,582	1,515	1,451
Surface, do.	1,066	1,080	1,046	1,051	1,053	1,084
Associated plants, do.	146	111	115	125	130	132
Production:						
Underground man-shift only, kilograms	3,890	4,103	4,243	4,477	4,870	5,165
Total man-shifts, do.	3,579	3,334	3,938	NA	NA	NA

[e] Estimate. NA Not available.
[1] Largely 14 to 18 percent volatile matter; a small tonnage has a higher volatile content.
[2] 16 to 28 percent volatile matter.
[3] 25 to 41 percent volatile matter.
[4] 40 to 42 percent volatile matter for the bulk of production in this category.
[5] Detail does not add to total (official data) because of differences in source.

The French coal industry continued to operate at a financial loss, estimated at $365 million in 1968 and expected to increase to $445 million in 1969. To reduce these losses, it is planned to reduce coal output to 25 million tons by 1975 or roughly 10 percent of energy consumption. The coal fields of the regions of Centre and Midi will be closed by about 1974; two mines will be closed in the Lorraine and the output of Nord/Pas-de-Calais will be reduced by 50 percent.

In October 1968 mechanized mines produced 68.8 percent of coal mined underground and semimechanized mines 17.1 percent. However, 96 percent of the output of the Lorraine field was from mechanized mines. In the same month, there was an average of 548 coal faces in operation with an average length of 138 meters.

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Average daily production per face was 278 tons. The reduction in number of coal faces from 640 in 1967 was attributable to concentration in mining and partly to reduced output. At yearend 1967 there were 60 underground coal mines in operation. Of these, three had daily production exceeding 8,000 tons, three with daily output from 5,500 to 7,500 tons, 18 with daily output from 2,000 to 5,500, and the remainder less than 2,000 tons per day.

In 1967, 88 percent of coal output was washed. Heavy media coal washers ranked first in coal preparation accounting for 54 percent of the coal washed, followed by jigs 35.5 percent, and flotation 9 percent.

Consumption and Trade.—In 1968 supply of coal totaled about 54 million tons, 43.3 million tons from domestic mines and stocks and 10.7 million tons net imports. Shipments of domestic and imported coal for making coke totaled about 16 million tons and shipments to electricity producers about 17 million tons. Household and small industries received 7.4 million tons of coal and presumably the bulk of the briquets produced from 4.3 million tons of domestic and imported coal.

Coal imports, 11.6 million tons (8.7 million tons bituminous coal and 2.9 million tons anthracite) were almost at the same level as in 1967. Principal suppliers were West Germany (6,338,000 tons), United States (1,573,000), U.S.S.R. (1,224,000 tons, mainly anthracite), Poland (786,000 tons), and Belgium (624,000 tons). Receipts from the United States were 28 percent less than in 1966. Average c.i.f. value per ton of bituminous coal was $14.93, and of anthracite $26.13. Values for bituminous ranged from a low of $11.31 per ton for Polish coal to $16.99 for imports from the Netherlands. Corresponding values for anthracite ranged from a low of $17.71 for anthracite from United Kingdom to $28.89 from the Soviet Union. About 69 percent of the bituminous coal and 54 percent of anthracite imports were from the European Economic Community.

Coke and Coal Chemicals.—Coke shipments, domestic and imported, totaled 15.1 million tons. Shipments to the iron and steel industry accounted for 83 percent and to other industries, 11.6 percent; the remainder was shipped to domestic and small industrial consumers. Charbonnage de France produced 64.6 percent of total domestic coke output; and the steel industry the remainder except for 219,000 tons produced by gas plants.

Coke imports which totaled 3,519,000 tons were received entirely from the EEC, principally West Germany (3,700,000).

Activities of the Société Chimique des Charbonnages in the area of chemical fertilizers was reported above under fertilizers.

Table 9.—France: Production, availability, and distribution of coal

(Thousand metric tons)

	1967	1968
Net production	47,624	41,911
Middlings, foreign coal, etc.	151	101
Stock variations [1]	+1,205	—1,251
Total availability	46,570	43,263
Consumption by mines and mine powerplant	7,419	[2] 6,185
Delivery to miners	801	725
Delivery for transformation:		
Mine coke ovens	9,370	8,711
Steel plant coke ovens	2,222	2,100
Gas coke ovens	84	29
Briquetting plants	3,733	3,549
Total	23,629	21,299
Exports	711	866
Total available from domestic production	[3] 22,237	21,198
Imports	11,557	11,512
Delivery from imports:		
Coal mine coke ovens	851	1,545
Steel plant coke ovens	3,322	3,466
Gas coke ovens	405	194
Briquetting plants	831	775
Delivery to mines	7	-------
Stock variations [1]	+147	—431
Available from imports	5,994	5,718
Available for domestic distribution	28,231	26,914
Railroads	790	512
Gasworks	11	11
Electricity	10,860	10,551
Iron and steel	1,848	1,943
Other industries	7,199	6,496
Domestic and small industries	7,523	7,401

[1] Plus (+) denotes addition to stocks.
[2] Exclude 100 tons of foreign coal.
[3] Includes 7 tons of foreign coal.

Petroleum.—Production decreased slightly and was 3.4 percent of total national refinery throughput, which increased to 81.3 million tons, 5.5 million tons of which were for custom refining. Civilian consumption of petroleum products increased 10.5 percent to 63 million tons. Imports of petroleum and petroleum products totaled $1.54 billion or 11 percent of all imports by value. Refinery capacity increased to 97.3 million tons from 83.8

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million tons in 1968. Net refinery output totaled 73 million tons.

Table 10.—France: Production availability and distribution of coke

(Thousand metric tons)

	1967	1968
Coal charged to coke ovens:		
Domestic	12,083	11,316
Imported	4,650	5,240
Total	16,733	16,556
Production:		
Oven coke:		
At mines:[1]	8,040	8,078
At iron and steel plants	4,166	4,211
At gas companies and independents	424	219
Total	12,630	12,503
Gas coke	9	8
Availability and distribution:		
Coke produced [1]	12,630	12,630
Receipt of coke and fines	-------	28
Consumption at coking plants and by labor	772	759
Available for distribution	11,859	11,772
Stock variation [2]	+38	—139
Imports	3,220	3,348
Importer's stocks variation [2]	—18	—92
Total available from domestic production and imports	15,098	15,016
Delivery to coking plants	3	39
Exports	210	259
Distribution:		
Railroads	57	47
Electricity	15	-------
Iron and steel	12,061	12,422
Other industries	1,801	1,752
Domestic use and small industries	912	895
Total	14,846	15,116

[1] Includes semicoke and carbonized briquets.
[2] Plus (+) denotes addition to stocks, minus (—) denotes withdrawal from stocks.

Source: Bureau de Documentation Minière, Combustibles Minéraux Solides. Statistique Annuelle Définitive. Paris, France, pt. 2, 1968.

Exploration.—Geophysical exploration almost entirely by seismic methods, declined about 13 percent to 69.2 equipment-months. A similar percentage decline to 104,100 meters was noted in drilling; of this 44,600 meters were in the Aquitaine (70,400 meters in 1967). SNPA was the most active firm in Aquitaine; Esso and ERAP were others.

Twenty-seven wells were completed as follows:

	Ore	Gas	Dry	Total
Wildcat			2	2
Exploration	1	1	10	12
Stepout and development	6	5	2	13
Total	7	6	14	27

Exploration and drilling was carried out in the Southeast and Savoy regions and at Meillon-St. Faust in the Aquitaine. Exploration activity in the Paris Basin declined. Two wells drilled by Elf-ERAP in the Aquitaine resulted in gas production at Auzas (100,000 cubic-meters-per-day) and discovery of oil impregnation in Albo-Aptian formations at Gaujacq. There was also a small oil discovery at well Brie 119 in Triassic in the Paris Basin.

Offshore search continued in 1968 in the Aquitaine Basin and Bay of Biscay and started at yearend near the Gulf of Lion. Two offshore wells were drilled in the Landes Atlantique concession of which one gave a noncommercial oil show. At yearend a drilling barge was positioned in the Gulf of Lion for Compagnie Française des Pétroles. Drilling will continue both in the Gulf of Lion and Gulf of Gascony.

Outside France, French companies increased their exploration activities. Exploration work, started in previous years, continued in the North Sea (on the Continental Shelves of United Kingdom and Norway), in offshore areas of Gabon and Tunisia, and on land in Canada, Libya, Algeria, and Australia. Permits were obtained in Tunisia, Somalia, Angola, Mozambique, Malagasy Republic, Republic of South Africa, Indonesia, offshore area of Oman, and off the coast of the Spanish Sahara. ERAP concluded an agreement with Iraq National Oil Company (INOC) to carry out exploration for the account of INOC. Discoveries were made outside of France in Norway, in the Adriatic, in Libya, in Gabon (offshore), in the United States, and Canada among others.

Production.—Crude production in France declined slightly but the output of the Franc zone (excluding France)—Algeria, Congo (Brazzaville), and Gabon—increased to 50 million tons of which Algeria 43 million tons and Gabon 4.6 million tons. World wide, French companies produced 71.3 million tons distributed as follows in million tons: Algeria 30.0; Middle East

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36.7; other Africa 3.3; North America 0.8; and France 0.5. Of the total world output by French companies, Compagnie Française des Pétroles accounted for 48.4 million tons and ERAP–SNPA 20.6 million tons. Crude production is expected in Tunisia.

Consumption.—Internal civilian consumption for all products totaled 62.9 million tons, an increase of 10 percent compared with the 13.9-percent increase in 1967. Events of May caused a decrease in consumption of some products. Consumption by type of products and variation compared with 1967 are shown in the following tabulation:[18]

Product	Consumption (thousand tons)	Percent of total	1968/1967 variation (percent)
Motor gasoline	10,689	17.0	8
Jet fuel and kerosine	[1] 1,250	2.0	1.5
Gas oil	3,885	6.1	11
Domestic fuel oil	23,122	36.8	18
Light fuel oil	2,332	4.0	—2
Heavy fuel oil	13,603	21.6	6
Petrochemical base	[p] 2,000	3.1	26
White spirits and special gasoline	168	2	3
LPG and similar products	2,576	4.0	—2
Lubricants	767	1.2	1.5
Bitumen	2,380	3.8	5
Paraffin, wax, and petroleum coke	168	.2	2.4
Total	62,939	100.0	10.0

[p] Preliminary.
[1] Includes 60,000 tons of aviation fuel.

Petroleum for products and energy uses totaled 57.5 million tons.

Taxes on gasolines and gas-oil were increased three times during the year—on January 1, August 1, and December 1. As a result on January 1, 1969 taxes accounted for 76 percent of the price of regular gasoline, 74 percent of the price of premium gasoline, and 67 percent of price of gas-oil at the gasoline stations. These prices were 87 cents per gallon for premium gasolines, 80 cents for regular gasoline, and 54 cents for gas-oil at the pump. Custom duties, taxes, and other duties on petroleum accounted for about 10 percent of budgetary receipts.

In 1968 French companies as a whole held 50.9 percent of the market for all petroleum products; the remainder was met by affiliates of international oil companies. The 1968 share of markets was as follows in percents: Compagnie Française des Pétroles $23.72; Esso 12.22, Elf-ERAP 12.96, Shell 16.91; BP 11.09; Antar 10.22; Mobil 5.30; French Independents 3.99; and Purfina 3.53.

Trade.—In 1968 crude oil imports increased by 7.8 percent to 77.2 million tons, of which 37,380,000 tons came from the Middle East and 24,866,000 from the Franc zone. Principal supplying countries and corresponding imports in thousand tons were as follows: Algeria 24,429; Iraq 15,160, Libya 10,818; Kuwait 7,282; Saudi Arabia 3,986; Oman-Abu Dhabi 5,046, Qatar 2,898, Iran 3,009; Venezuela 2,345 and U.S.S.R. 1,554. Product imports increased slightly to 5.2 million tons from 4.9 million tons in 1967.

Exports of products totaled 10.9 million tons including about half a million tons

[18] Comité Professionel du Pétrole. Eléments Statistiques, Activité de l'Industrie Pétrolière. (Statistical Data, The Activity of the Petroleum Industry). 1968. Paris, France. V. 1, 1968, p. C 7.

Table 11.—France: Nominal capacity of petroleum refineries on December 31, 1968[1]

(Thousand tons per year)

Company and location	Capacity
Société Française des Pétroles BP:	
Dunkerque-St. Pol-sur-Mer	5,500
Lavéra	4,400
Antar P.A.:	
Donges	4,575
Vern-sur-Seiche	1,400
Esso-Standard S.A.F.:	
Port Jérôme	6,000
Bordeaux	2,600
Fos-sur-Mer	3,000
Mobile Oil Française:	
N.D. de Gravenchon	3,600
Frontignan	1,730
Cié de Raffinage Shell-Berre:	
Petit-Couronne	9,200
Pauillac	500
Berre-l' Étang	7,000
Elf-Erap:	
Gargenville (Vexin)	3,600
Ambès (Elf-UIP)	2,000
Feyzin	6,000
Grandpuits (Cie de la Raffinerie de l'Isle de France)	3,600
Compagnie Française de Raffinage:	
Gonfreville (Raffinerie de Normandie)	14,300
La Mède (Raffinerie de Provence)	10,235
Société de la Raffinerie de Strassbourg Herrlisheim	4,400
Société Rhénane de Raffinage Reichstett	3,700
Total	97,340

[1] Source: Ministère de l'Industrie, Direction des Carburants. Activité de l'Industrie Pétroliére 1968, Éléments Statistiques. Paris, p. 87.

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of liquefied petroleum gas (LPG). An additional 2 million tons was supplied to foreign ships.

Refining.—French refineries treated 81.3 million tons of crude and produced 75.7 million tons of petroleum products. One-third of the crude processed in French refineries was from the Franc zone; Middle East countries accounted for 47 percent, Libya 14 percent, Venezuela 3.3 percent, and the U.S.S.R. 2.2 percent.

During the year France's refining capacity increased by 13.5 million tons to a total of 97.3 million tons. Of this 3.6 million tons resulted from the startup of the new Ile de France refinery and the remainder from additions to existing refineries which were as follows in million tons of annual capacity: La Mède 3.8, Feyzin 4.0, Port-Jérôme 1.2; Berre l'Etang 0.5, and Vern-sur-Seiche 0.2. Before the end of 1970, an additional 16.3 million tons of annual capacity will be commissioned.

The steam cracking unit in the Berre refinery, scheduled for completion in 1968, went into operation. This is the third similar unit in France installed to meet increasing requirements of the petrochemical industry. Principal petrochemical outputs and increase relative to 1967 levels were as follows:

Commodity	Production (thousand tons)	Increase relative to 1967 (percent)
Ethylene	520	50
Propylene	330	25
Butadiene	88	40
Benzene	154	55

Compagnie Française de Raffinage (CFR) and Compagnie Française des Pétroles on November 6, formed Total Chimie with 50-percent participation by each to build and operate large-scale petrochemical plants. CFR entered into an agreement with the German firms Scholven Chemie and Chemische Werke Huls to build a petrochemical plant in Le Havre. This will necessitate addition of a steam cracking unit to the Gonfreville refinery.

Stocks and Storage.—The Direction des Carburants has imposed a stock requirement sufficient for 90-day consumption. These stocks would include operational and reserve stock. Storage capacity for petroleum and petroleum products increased almost 4 million cubic meters during the year to a total of 31,546,000 cubic meters (2.6 times the 1960 capacity) of which 24,924,000 was storage capacity of refineries and 6,622,000 tons was storage of distributors. Byproducts, storage facilities were as follows in thousand cubic meters: crude 7,723, intermediate products 5,534, and finished products 18,739.

To reduce cost of building storage tanks, attention is being given to underground storage and the first underground storage will come into use in July 1969. The underground storage will be in a salt deposit at Manosque and have 5-million-ton capacity. For this capacity, the cost at $6 per cubic meter of capacity is estimated to be half that for surface tanks.

This underground storage belongs to a Consortium of Compagnie Française de Raffinage, Cie de Raffinage Shell Berre, Elf Union and British Petroleum which formed a joint subsidiary La Société Francaise de Stockage Géologique (Geostock). Manosque will be connected by a pipeline with the refineries in Étang le Berre.

Transportation.—The South European Pipeline (SEP) transported 23,719,000 tons of crude in 1968. Tonages transported by this line declined both in 1967 and 1968 from the 31.1 million ton maximum achieved in 1966. The decline resulted from operation of the Genoa-Ingolstadt and Trieste-Ingolstadt-Karlsruhe lines. In 1968, 46 percent of the crude transported by SEP was for France, 44.3 percent for West Germany and 9.7 percent for Switzerland. However, it is expected that this line will transport large-tonnages (27 million tons) when the Worth refinery in West Germany and Hautconcourt refinery in France are put in operation and the Karlsruhe and Klarenthal refineries in West Germany are expanded. At yearend the product pipeline Mediterranée-Rhône with 5 million tons annual capacity was put into service. This pipeline will transport products from the Étang de Berre refinery to Lyon, Grenoble, and Annecy, and to Geneva in Switzerland. The Le Havre-Paris (Trapil) and the Grandpuits-Paris pipelines carried 6.7 million tons of product to the Paris area. The branch line Petit-Couronne-Rouen carried 650,000 tons.

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The French tanker fleet increased 9.3 percent to 4,738,000 tons on January 1, 1969 and was 3.8 percent of world tonnage.

Natural Gas.—Sale of natural gas produced in southeast France, exclusive of natural gas imported from Algeria and the Netherlands totaled 5,544.7 million cubic meters of which 74.11 percent was for industrial use, 25.35 percent for domestic use including small industries, and the remainder for other uses.

In October 1968 new processing units, with a capacity of 3 million cubic meters per day of crude gas to be increased to 5 million cubic meters in October 1969, were receiving gas from the Pont d'As field. The production from this field will be increased.

The French group, headed by ERAP's Petroland discovered natural gas at Leeuwarden in the Netherlands (onshore) and was awaiting a concession. The group made an arrangement whereby Gas de France will take an extra 400 million cubic meters of natural gas yearly from Groningen field, produced by Shell-Esso, which will get an equal quantity of Leeuwarden gas.[19]

Natural gas imports from the Netherlands increased to 1.3 billion cubic meters; imports from Algeria remained at the 1967 level of 500 million cubic meters.

[19] Petroleum Intelligence Weekly, Jan. 27, 1969, p. 5.

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The Mineral Industry of Gabon

By Edgar J. Gealy[1] and Agnes J. Doughman[2]

The continued rise of Gabon's economy in 1968 was stimulated by further expansion of all phases of petroleum activities including exploration, development, crude production, and refining. Production of other mineral resources in 1968 was in aggregate, close to levels established in previous years; manganese ore output exceeded 1967 levels while output of gold and uranium declined. Virtually all of the minerals produced in Gabon were for the export market. For some years, wood and wood products had been Gabon's largest single export in terms of value, but in 1968 was exceeded by crude petroleum. All mineral exports, including petroleum, probably accounted for about two-thirds of the total value of Gabon exports with wood and wood products making up less than one-third.

The impact of petroleum expansion on the domestic economy is clearly indicated in the rise in per capita income from $220 in 1960 to $500 in 1968. An 8-percent increase in the minimum wage to $0.19 per hour granted in June 1968 and the rise in the cost of French goods, which made up about 60 percent of Gabon's imports, apparently were responsible in part for increases in local prices during the latter part of 1968.

Construction of the Owendo deepwater port was inaugurated by the ceremonial laying of a cornerstone in June 1968 although actual work was not to begin until January 1969. Final completion is scheduled for 1971. The Owendo-Belinga railroad, necessary to exploitation of the iron resources and the interior forest, was still in the discussion and planning stage.

In March 1968, Chad and the Central African Republic announced their withdrawal from the Central African Customs and Economic Union (UDEAC) leaving Gabon, Cameroon, and Congo (Brazzaville) as the only remaining members. The Port Gentil refinery in Gabon, while sponsored under UDEAC, had been established by a protocol and thus was not affected by the withdrawal.

[1] Assistant to the Chief, Division of International Activities.
[2] Statistical assistant, Division of International Activities.

PRODUCTION

Gabonese mineral production, with the exception of gold and uranium, increased in 1968. The largest increases were made by marketed natural gas (44 percent) and crude petroleum (33 percent). Production at the petroleum refinery in 1968, the first full year of operation, was 10 times greater than in 1967. The value of total mineral production in 1968 was about $120 million, a 50-percent increase over the 1967 value.

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Table 1.—Gabon: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Gold—troy ounces	42,760	37,134	r 34,433	29,250	16,724
Manganese:					
Ore 50–53 percent Mn	959,576	r 1,274,607	r 1,267,781	r 1,124,000	1,220,862
Battery and chemical grade pellets, 82–84 percent Mn	---	5,789	5,739	r 23,000	32,705
Uranium, concentrate 20–40 percent U_3O_8	1,287	1,591	1,599	1,452	1,371
NONMETALS					
Limestone	---	---	---	---	1,253,567
MINERAL FUELS AND RELATED MATERIALS					
Natural gas, marketed—million cubic feet	r 334	r 376	r 405	r 611	879
Petroleum:					
Crude—thousand 42-gallon barrels	7,668	9,161	10,484	25,203	33,630
Refinery products:					
Gasoline—do	---	---	---	93	1,019
Kerosine and jet fuel—do	---	---	---	r 65	713
Distillate fuel oil—do	---	---	---	99	1,255
Residual fuel oil—do	---	---	---	224	1,911
Other—do	---	---	---	6	26
Total—do	---	---	---	487	4,924
Refinery fuel and loss—do	---	---	---	17	220

r Revised.

TRADE

In terms of value, 64 percent of Gabon's exports in 1967 were mineral products, as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	[1] 54.3	104.9
1966	56.7	r 100.8
1967	77.4	120.2
Imports:		
1965	8.4	62.4
1966	r 8.8	r 65.7
1967	10.7	67.2

r Revised.
[1] Adjusted, based on revised import data, U.S. Agency for International Development Data Book, 1968.

Most of the mineral product export value was accounted for by petroleum 46 percent, manganese 42 percent, and uranium 10 percent. Gabon is dependent on imports for a large portion of its food products and nearly all manufactured goods.

France continued to be Gabon's principal trading partner in 1967 supplying 60 percent by value of total imports, while receiving 36 percent of total exports. The United States, the major recipient of manganese ore, ranked second receiving 19 percent by value of total exports.

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Table 2.—Gabon: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Gold—troy ounces	29,643	22,763	All to France.
Iron and steel:			
Scrap	510	----	
Semimanufactures	571	2,575	West Germany 2,034; France 257.
Manganese: Ore and concentrate	1,181,027	1,226,420	United States 776,832; France 156,734; West Germany 146,231.
Uranium, ore and concentrate	1,444	1,398	All to France.
Other:			
Ore and concentrate	----	23	All to France.
Nonferrous metal scrap, n.e.s	71	20	Senegal 13.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude—thousand 42-gallon barrels	r 11,083	25,068	France 5,841; Curacao 3,683; Netherlands 3,024.
Refinery products—do	----	102	All to United States.

r Revised.

Table 3.—Gabon: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Commodity	1966	1967
METALS			NONMETALS—Continued		
Aluminum, metal, including alloys, all forms	51	58	Clays and clay products	422	583
Copper, metal, including alloys, all forms	35	43	Fertilizer materials, manufactured	215	134
Iron and steel:			Stone, sand, and gravel	220	67
Pig iron, ferroalloys and similar materials	7	----	Sulfur, elemental, all forms	1,479	1,791
Semimanufactures	r 14,291	13,920	Other nonmetals:		
Lead, metal, including alloys, all forms	11	8	Crude	5,088	7,922
Tin, metal, including alloys, all forms—long tons	1	1	Manufactures	41	209
Zinc, metal, including alloys, all forms	9	8	MINERAL FUELS AND RELATED MATERIALS		
NONMETALS			Coal and coke, including briquets	13	----
Abrasives, natural, n.e.s	1	1	Gas, hydrocarbon	686	810
Cement, lime, and dimension stone, worked	40,715	39,990	Petroleum, refinery products thousand 42-gallon barrels	663	642
			Mineral tar and other coal, petroleum or gas derived crude chemicals	12	3

r Revised.

COMMODITY REVIEW

METALS

Gold.—The mining of gold was from alluvial deposits along Gabon's rivers under the control of the Government's Société Gabonaise de Recherches et d'Exploitation (SOGAREM). The 1968 production was down 43 percent from that of the previous year and 61 percent below that during the peak year of 1964 as the alluvial resources were being exhausted. The company expects to increase gold production in the coming years as mining of primary gold deposits replaces surface working of alluvial deposits.

Iron Ore.—Development of the Belinga-Mekambo iron deposits will depend on construction of the Owendo-Belinga railroad. The Gabonese Government created a new set of taxes beginning January 1, 1969, to benefit its "Investment Fund for the Owendo-Belinga Railroad." These taxes are expected to contribute about $4 million annually to a total target of $20 million in 5 years. However, unless the Government is successful in enlisting international financial aid, it will be some time before the project materializes. Known reserves of the iron deposits have been estimated at

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1 billion tons containing 60 to 69 percent iron.

Bethlehem Steel has a 50-percent interest in the deposits, the remainder being held by French firms; Bethlehem indicated a desire to reduce its holdings to 25 percent.

Manganese.—Production of manganese ore in 1968 increased 9 percent over that during 1967 but was 4 percent below that during the peak year of 1965.

The Compagnie Miniere de l'Ogooue (COMILOG), in which United States Steel Corp. has a 49-percent interest, produced the entire output from the Moanda ore body in southeastern Gabon. It is reported that exports in 1968 decreased an estimated 3 percent; this was attributed to the decline in world market prices for manganese ore, increased international competition, and sales from the United States stockpile. However, the United States has consistently been the recipient of over 60 percent of the annual exports of Gabonese manganese ore. There were strong indications that the 1968 unit value of manganese ore exports was considerably lower than in 1967 because of the increased world competition. Export capacity, measured as the amount of ore which can be moved to port over the bucket cableway-railroad system, was approximately 1.4 million tons per year. COMILOG was stockpiling ore at Pointe Noire against any temporary transport breakdown.

Uranium.—The only uranium producer, Compagnie des Mines d'Uranium de Franceville (COMUF), continued exploration in the Mouana-Franceville area. Reserves are estimated at 10,000 tons of uranium metal. On July 8, 1968, the Government issued an exploration permit to the French Commissariat a l'Energie Atomique (CEA) for lithium, uranium, and thorium in a 2,000-square-mile area between Cocobeach and Bifoum.

NONMETALS

Cement.—The construction of a cement clinker crushing plant at Owendo began in March 1968. It was expected to be about 1 year before the plant would be in operation. The plant was financed by Ciments de Marseille et d'Outre-mer and the Société Ouest-Africane des Ciments (SOCOCIM) 70 percent, Gabonese Government 20 percent, and private shareholders 10 percent. Initial capacity was to be 50,000 tons of crushed cement annually. When domestic consumption increases sufficiently to justify the cost, kilns will be installed to use domestic limestone and to double the plant capacity for finished cement.

Fertilizer Materials.—Gabon relies on imports for its requirements of small quantities of fertilizer materials. It is reported that a new company, Société Gabonaise de Chimie, was formed to explore the possibility of constructing a natural gas based ammonia and urea plant at Port Gentil with government assistance.

Limestone.—Gabon has quarried limestone near Libreville for some years, however, annual production was first reported in 1968 as over 1 million tons, used chiefly for construction. Deposits of limestone are also known near Port Gentil and on the island of Coniquet where the existence of a high-quality limestone deposit on the coast is unique in West Africa.

MINERAL FUELS

Natural Gas.—Reserves of natural gas have been estimated at 2,800 million cubic meters. About 10 percent of the gas produced was used, the remainder being flared.

It was reported that the Government has contacted Belgian firms regarding exploitation of Gabon's natural gas resources, but details are not yet available.

Petroleum.—Production of crude oil reached 33.6 million barrels in 1968, ranking Gabon as Africa's fifth largest oil-producing country. By 1971 output is expected to double with one-half coming from Anguille and other offshore fields in the Port Gentil area.

The final agreement granting oil concession rights in Gabon was signed September 21, 1968. Five companies or combines are now involved holding onshore and offshore exploration permits in coastal waters to a distance of over 50 kilometers from shore. The Société ELF des Pétroles d'Afrique Equatoriale (ELF–SPAFE) has permits covering 37,328 square miles and together with Shell of Gabon holds permits on an additional 5,666 square miles. ELF–SPAFE will further test its Port Gentil North and South permits and evaluate three strikes made in Anguille Northeast, Anguille Southwest, and Torpille. Work has pro-

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gressed in the main Anguille field where ELF–SPAFE already holds a 75-year exploration concession and reserves are estimated at 145 million barrels with a low sulfur content. A well drilled early in 1968 was the first in the world with an underwater wellhead laid down from a drilling rig. A 75-year exploitation permit is also held by ELF–SPAFE covering the nearby Tchenque field. In the area combined with Shell, the most promising is the Sette Cama permit containing Gamba field. Deposits in Sette Cama are estimated to contain about 525 million barrels of extremely paraffinic but sulfur-free oil, of which about 40 percent would probably be recoverable. The exploration permit is valid until January 1, 1971, but may be renewed with a 50-percent reduction in area or turned into an exploitation concession.

Gulf Oil Company of Gabon was granted a 2-year exploration permit in August 1967, covering the 2,354-square-mile Mayumba-Iguela area, with a renewal option retaining no more than 80 percent of the original area. Gulf also has a 50–50 deal with Shell on a 1,930-square-mile area off Libreville. This area was granted at the same time as the Mayumba permit and carries identical expiration and relinquishment clauses. Gulf has completed its seismic program and drilling operations were expected to start in early 1969. An agreement was signed September 21, 1968, by American Overseas Petroleum Co., owned jointly by Texaco Oil Co. and Standard Oil of California (Chevron), for a permit that had been granted May 15, 1968. It covers a 1,242-square-mile area between Port Gentil and Libreville. Texaco Oil Co. will operate the Texaco-Chevron concession and will have up to 10 years to identify 50 percent of the original area for exploitation.

The Port Gentil refinery operated at capacity during 1968, producing most of the major petroleum products with the exception of aviation gasoline, lubricants, and tars, which are imported. Priority is given to refining Gabonese oil, although the refinery is equipped to use imported crude oil. At the current consumption growth rate, construction of a second refinery with a projected capacity of 10,000 barrels daily will probably be required between 1972 and 1976.

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The Mineral Industry of East Germany

By Bernadette Michalski [1]

In 1968, East Germany's most significant mining activities, lignite and potash, operated at a level that met domestic and foreign demand. Most investment was directed toward the aluminum, iron and steel, and petroleum industries, which are based primarily on imported raw materials. Especially in the steel industry, a number of organizational measures were carried out or proposed, including the amalgamation of enterprises into combines and the concentration of the production of specific products into single enterprises. No marked increase in productivity resulting from these measures is expected before 1970.

Economic objectives for the year were reportedly attained. The overall industrial production index in 1968 was 136, compared with 127 for 1967 (1963=100). However, the rate of growth in several industrial sections declined, as shown in the following tabulation:

Industrial sector	Percent growth over previous year	
	1967	1968
Primary product plants	3.7	2.5
Mining	6.3	5.7
Metal semimanufactures and products	8.6	6.9

PRODUCTION

Available statistics on the East German mineral industry indicate an overall increase in production with the exception of iron ore. The decline in iron ore output was attributable to inadequate reserves of economic ores. Production figures for nonferrous metals were not available. The estimates included here show orders of magnitude and indicate relatively little change in output.

In the nonmetal sector there was little change in output levels. An ammonia plant of 200,000-ton annual capacity in the Schwedt chemical complex designed by Humphreys and Glasgow Ltd., of the United Kingdom, started operation in 1968. This should substantially increase manufactured nitrogen fertilizer production, presently 350,000 tons per year.

The Ruedersdorf building materials plant announced initial production of pozzolan cement manufactured from coal fly ash rather than the conventional furnace slag material. The proposed annual output of pozzolan cement 225 was 170,000 tons.

[1] Foreign mineral specialist, Division of International Activities.

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Table 1.—East Germany: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Aluminum, metal, including secondary •	65,000	70,000	80,000	80,000	80,000
Cadmium •—kilograms	10,000	10,000	10,000	12,000	12,000
Copper:					
Mine output, metal content	22,000	20,500	18,900	20,000	20,000
Metal, including secondary •	40,000	40,000	40,000	40,000	40,000
Iron and steel:					
Iron ore and concentrate—thousand tons	1,634	1,630	1,721	1,680	•1,450
Pig iron—do	2,260	2,338	2,448	2,525	2,333
Steel, ingots and castings—do	3,852	3,890	4,084	4,243	4,374
Steel semimanufactures—do	2,900	2,986	3,050	3,075	3,177
Lead:					
Mine output, metal content •	10,000	10,000	11,000	11,000	12,000
Metal, including secondary •	25,000	25,000	25,000	25,000	25,000
Silver, mine output, metal content • thousand troy ounces	4,800	4,800	4,800	4,800	4,800
Tin, mine output, metal content •—long tons	1,000	1,000	1,000	1,000	1,000
Tin metal, including secondary •—do	1,200	1,200	1,200	1,200	1,200
Zinc:					
Mine output, metal content •	10,000	10,000	12,000	12,000	12,000
Metal, excluding secondary •	14,000	14,000	14,000	14,000	14,000
NONMETALS					
Barite •	30,000	30,000	30,000	30,000	30,000
Cement—thousand tons	5,767	6,087	6,456	7,182	7,550
Fertilizer materials:					
Crude: Potash, K_2O equivalent thousand tons	1,857	1,926	2,006	2,206	•2,200
Manufactured:					
Nitrogenous, N content—do	334	348	344	336	•340
Phosphatic, P_2O_5 content—do	198	232	254	305	360
Fluorspar, all grades •	70,000	80,000	80,000	80,000	80,000
Gypsum and anhydrite, calcined thousand tons	223	217	218	229	NA
Lime and dead-burned dolomite—do	3,673	3,441	3,662	3,589	NA
Pyrite:					
Gross weight—do	100	105	129	129	•140
Sulfur content—do	42	44	54	54	•58
Salt, all types—do	2,078	1,890	1,911	•2,000	•2,000
Sulfur, elemental—do	125	125	128	128	•125
MINERAL FUELS					
Coal:					
Anthracite and bituminous—do	2,340	2,212	1,987	2,789	NA
Lignite and brown—do	256,926	250,836	249,086	242,027	247,200
Coke:					
Bituminous coke and gas coke—do	3,398	3,209	3,191	2,921	NA
Brown coal coke and high-temperature coke thousand tons	7,608	7,342	7,328	6,958	NA
Fuel briquets, all grades—do	61,504	60,380	59,426	56,037	NA
Gas, manufactured, all types million cubic feet	112,830	120,241	122,228	125,365	•140,000
Petroleum, refinery products:					
Gasoline—thousand tons	1,461	1,604	1,776	1,852	NA
Diesel oil—do	2,024	2,258	2,556	2,693	NA
Fuel oil—do	1,936	2,248	NA	NA	NA

• Estimate. NA Not available.

[1] In addition to reported commodities, East Germany produced magnesium, nickel, and peat, but level of output is unknown.

Sources: Staatlichen Zentralverwaltung fur Statistik (Central Statistical Bureau); Statistisches Jahrbuch der Deutschen Demokratischen Republik 1968 (Statistical Yearbook of the Germany Democratic Republic for 1968), Berlin, 1968, 608 pp.; Metallgesellschaft Aktiengesellschaft (Metal Statistics) 1958–67, Frankfurt am Main, 1968, 302 pp.

TRADE

Lignite, fertilizers, nonferrous metals, and steel semimanufactures constituted the bulk of East Germany's limited mineral exports. The market for these products was largely in West Europe (US$150 million in 1967); the Federal Republic of Germany, the United Kingdom, and Italy were among the principal buyers. Mineral exports to the Federal Republic in 1967 were valued at $50 million. Coal briquets accounted for half the value, iron and steel products for about 30 percent, and nonferrous metals and petroleum products for the remainder. Exports to the Federal Republic totaled $54 million in 1968, with advances recorded in steel and nonferrous metals semimanufactures.

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Table 2.—East Germany: Exports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations 1967
METALS			
Aluminum:			
Metal, including alloys: [2]			
Scrap	2,519	NA	
Unwrought	r 12,917	NA	
Copper, metal, including alloys: [2] unwrought and semimanufactures.	1,802	NA	
Iron and steel: [2]			
Scrap	131,631	NA	
Pig iron, ferroalloys, and similar materials	307,984	NA	
Steel, primary forms	2,090	NA	
Semimanufactures	73,728	NA	
Lead, metal, including alloys: [2]			
Scrap	420	NA	
Unwrought	636	NA	
Tin, metal, including alloys, long tons, all forms.[2]	49	NA	
Tungsten, ores and concentrates [2]	30	NA	
Zinc, metal, including alloys: [2]			
Unwrought	3,607	NA	
NONMETALS			
Cement	229,900	356,400	Undisclosed.
Clays, kaolin	72,670	79,763	Do.
Fertilizer materials:			
Crude: Potash	9,393	8,648	Do.
Manufactured:			
Nitrogenous, N content	48,265	70,851	India 20,721.
Potassic K_2O thousand tons equivalent.	1,374	1,540	Poland 469; Czechoslovakia 353; United Kingdom 138.
Fluorspar	45,000	56,000	Poland 12,400.
Gypsum, dead-burned	33,094	59,201	Undisclosed.
Salt (excluding brines) thousand tons	667	717	Czechoslovakia 537.
Sulfur, elemental, all forms	8,032	11,583	Undisclosed.
MINERAL FUELS			
Carbon black	2,251	NA	
Coal, lignite briquets thousand tons	5,255	3,948	West Germany 1,370; Czechoslovakia 709; Hungary 525; Austria 320.
Coke do	73	65	Undisclosed.
Petroleum, refinery products:			
Gasoline thousand tons	573	500	U.S.S.R. 237,[3] Poland 100.[4]
Diesel oil do	513	427	Undisclosed.
Residual fuel oil do	204	232	Austria 52.
Mineral jelly and wax do	85	80	Colombia 15; Poland 6; Brazil 4.

r Revised. NA Not available.

[1] Because East Germany publishes only limited data on foreign trade in minerals, this table has been compiled from several sources. Except as noted, information is from Statistisches Jahrbuch der Deutschen Demokratischen Republik 1968 (Statistical Yearbook of the German Democratic Republic 1968), Belrin, 608 pp.

[2] Statistical Office of the United Nations. 1967 Supplement to the World Trade Annual. V. 1, East Europe. Walker and Co., New York, 1969, 395 pp. (excludes exports to West Germany).

[3] Ministerstvo Vneshney Torgovli S.S.S.R. (Ministry of Foreign Trade of U.S.S.R.). Vneshnyaya Torgovlya S.S.S.R. za 1967 God (Foreign Trade of the U.S.S.R. for 1967). Moscow, 1968, 395 pp.

[4] Glowny Urzad Statystyczny (Central Statistical Office). Rocznik Statystyczny Handlu Zagranicznego 1967 (Foreign Trade Statistical Annual for 1967). Warsaw, 1968, 395 pp.

Primary and processed metals, petroleum, and bituminous coal dominated East Germany's mineral imports. The U.S.S.R. continued to be the principal source for these materials, supplying approximately $700 million of minerals and metals in 1967 and an estimated $775 million in 1968.

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Table 3.—East Germany: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	290,100	319,038	Hungary 223,288; Yugoslavia 86,717.
Oxide and hydroxide	29,058	50,101	Hungary 13,201.
Metal, including alloys:			
Unwrought	90,000	92,500	All from the U.S.S.R.
Semimanufactures	13,300	14,900	Mainly from the U.S.S.R.
Cadmium, metal, including alloys, all forms [2 3]	306	230	All from the U.S.S.R.
Chromite, Cr_2O_3 content	29,590	35,520	U.S.S.R. 22,000.
Copper, metal, including alloys, all forms [2]	43,200	43,800	All from the U.S.S.R.
Iron and steel:			
Ore and concentrate, thousand tons	2,900	3,100	U.S.S.R. 2,565; India 230.
Metal:			
Scrap [2], do.	154	206	All from the U.S.S.R.
Pig iron and ferroalloys, do.	649	723	U.S.S.R. 715.
Semimanufactures, do.	r 2,773	2,726	Mainly from the U.S.S.R.
Lead, metal, including alloys, all forms	45,800	44,300	Do.
Magnesium, metal, including alloys [2]	1,493	1,807	All from the U.S.S.R.
Manganese ore, Mn content, thousand tons	74	76	U.S.S.R. 60; Rumania 16.
Nickel, metal, including alloys, all forms [2]	2,100	NA	
Zinc, metal, including alloys, all forms	r 36,500	41,200	Mainly from the U.S.S.R.
NONMETALS			
Asbestos	26,839	38,340	Do.
Fertilizer materials:			
Crude: Apatite ore and concentrate	795,000	944,900	All from the U.S.S.R.
Manufactured:			
Nitrogenous fertilizers, N content	112,855	111,483	West Germany 90,640.
Phosphatic fertilizers, P_2O_5 content	r 75,368	57,212	All from the U.S.S.R.
Graphite, natural	4,449	5,548	Mainly from the U.S.S.R.
Pyrite, gross weight	107,805	108,890	All from the U.S.S.R.
Sulfur, elemental, all forms	6,970	NA	
MINERAL FUELS			
Carbon black	r 7,712	7,944	Rumania 5,866.
Coal:			
Anthracite [2], thousand tons	109	118	All from the U.S.S.R.
Bituminous, do.	r 9,179	8,274	U.S.S.R. 5,035; Poland 2,075.
Brown coal, do.	5,066	3,732	Mainly from Poland.
Coke, do.	3,232	2,879	U.S.S.R. 1,256; Poland 894; Czechoslovakia 643.
Gas, manufactured, million cubic feet	2,246	1,340	Undisclosed.
Petroleum:			
Crude, thousand tons	6,440	6,440	U.S.S.R. 5,835; United Arab Republic 97.
Refinery products:			
Gasoline [2], do.	r 132	59	All from the U.S.S.R.
Diesel fuel oil [2], do.	44	32	Do.
Lubricants [2], do.	21	16	Do.
Petroleum coke [2], do.	12	16	Do.

r Revised. NA Not available.

[1] Because East Germany publishes only limited data on foreign trade in minerals, this table has been compiled from several sources. Except as noted, information is from Statistisches Jahrbuch der Deutschen Demokratischen Republik 1968 (Statistical Yearbook of the German Democratic Republic 1968). Berlin, 1968, 608 pp.

[2] Ministerstvo Vneshney Torgovli S.S.S.R. (Ministry of Foreign Trade of U.S.S.R.). Vneshnyaya Torgovlya S.S.S.R. za 1967 God (Foreign Trade of the U.S.S.R. for 1967). Moscow, 1968, 395 pp.

[3] Glowny Urzad Statystyczny (Central Statistical Office). Rocznik Statystyczny Handlu Zagranicznego 1967 (Foreign Trade Statistical Annual for 1967). Warsaw, 1968, 395 pp.

COMMODITY REVIEW

METALS

Aluminum.—Since 1964, the aluminum industry has undergone expansion to accommodate increased imports of bauxite and alumina. East Germany's largest aluminum smelter, VEB Electrochemisches Kombinat Bitterfeld, increased its annual capacity from 35,000 to 55,000 tons, processing alumina produced at Lauta from imported bauxite. East Germany's second smelter, the Lauta Werke, with an annual capacity of 20,000 tons in 1967, is also located at Lauta. Including the more than 90,000 tons of aluminum ingot imported from the U.S.S.R., the available supply was approximately 170,000 tons. East German aluminum consumption requirements are estimated at 120,000 tons, permitting a significant export surplus. Presumably, the increased nonferrous metal exports to West Germany, valued at $0.8 million in 1966, $3.0 million in 1967, and $7.5 million in

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1968, also included increased aluminum shipments.

Iron and Steel.—Plans were approved in 1968 for the reorganization of the steel industry with emphasis on rationalization. The objective was to concentrate output of various types of steel in different combines. High-grade and alloy steel production will be centered in the Hennigsdorfkombinat which will also produce 69 percent of all the crude steel and 86 percent of the plate production in East Germany. The combine comprises a number of affiliate plants, including VEB Stahl und Walzwerk at Brandenburg; Edelstahlwerk "8 Mai 1945" at Freital; and Maxhutte, Bergbau und Huettenkombinat at Unterwellenborn. The Eisenhuettenkombinat Ost should account for the total output of sheet, light steel sections, and hot-rolled strip and about a third of the cold-rolled strip production. The Riesakombinat, including VEB Stahl und Walzerk Riesa, should produce about 83 percent of the total seamless and welded tube output.

MINERAL FUELS

Lignite remained East Germany's dominant energy source despite a decline in the domestic and export market. A significant policy decision was announced by the Minister for Raw Material Industries, which involved the role of nuclear energy in the total energy market of the country. At least two nuclear powerplants were in operation in 1968, and agreements with the U.S.S.R. were effected to establish additional nuclear power stations.

Growing imports of U.S.S.R. natural gas and petroleum were slated for use by the chemical industry and for the production of liquid fuels and gasoline. During 1968, expansion of the Schwedt refinery was underway to accommodate a second U.S.S.R. pipeline, the Rostock, in the Baltic which is to be completed in 1969. The refinery's 1967 annual capacity of 4.5 million tons should be expanded to 7.8 million tons in 1969.

At yearend, the French firms Ensa and Speichim (Société pour l'Equipement des Industries Chimiques), accepted a contract for the construction of a chemical complex at Leipzig for the production of polyether alcohols and isocyanates. The Ensa firm had also delivered nitric acid and fertilizer units as well as an acrylon unit to the Schwedt plant.

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The Mineral Industry of the Federal Republic of Germany

By L. Nahai [1]

The West German economy in 1968 rebounded from its 1967 stagnation and the gross national product (GNP) estimated at about $132 billion, marked an 8.9 percent increase in current prices and 6.9 percent in constant prices. Industrial investment gave the main impulse to expansion. Metal consumption was influenced by the upswing in the economy and, in spite of increases in production, imports were necessary to meet the domestic needs for many items.

The total value of crude minerals production in 1968 is not available, but probably was close to $3 billion.[2] In 1967 the contributions of the different sectors of the mineral industry to the GNP ($121,500 million) were as follows, in millions: Mining, $2,170; ferrous and nonferrous metal industries, $4,180; industries based on earth and stone, fine ceramics, and glass (includes output of some industrial sectors that are properly classified as manufacturing) $2,680. The total of $9,030 million (ignoring duplication of the value of minerals used in smelting and processing) was equivalent to 7.4 percent of the 1967 GNP. The chemical industry, which includes petroleum refining, contributed $6,472 million to the GNP in 1967.

Total turnover in the mineral industry in 1968 for the various operations shown in table 1 was about 15.2 percent of the $108,934 million recorded turnover for all industry. Average monthly industrial employment totaled 7,889,000 with employment in the mineral industry as indicated in table 1.

Government mineral-related actions concerned principally coal and petroleum. The decision to establish the Ruhrkohle A.G. which will concentrate ownership of most of the Ruhr coal companies in a single organization was the major development in the coal industry in 1968. The mining assets of 23 of the 29 Ruhr heavy industry companies, with coal interests, valued at $502 million, will be transferred to the new holding company which will assume their long-term debt of $300 million which will be paid in 20 years with 6-percent interest. The transaction was guaranteed by the Federal and State governments in the respective proportions of two-thirds and one-third. Ruhrkohle A.G. was set up through the efforts of the Federal Economics Minister to rationalize the coal industry and phase out uneconomic pits. It is anticipated that the new holding company will facilitate long-range investment planning; the rationalization of production; centralized purchasing and merchandising; and long-term personnel policies. With turnover of $2.54 billion in 1968 and property valued at $1,875 million, the unified coal company will be one of the 10 largest organizations in West Germany.

Government policies to rationalize the coal industry were embodied in the Law on the Adjustment and Recovery of German Hard Coal Mining and the German Hard Coal Mining Areas of May 5, 1968, which granted a number of tax privileges to promote the concentration of coal mining enterprises and the improvement of the economic structure in coal mining areas. Under this law, profits accruing in the process of reorganization and merger were exempted from taxes under certain conditions and such reorganizations and mergers were exempted from taxation under the Capital Transfer Tax Law.

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[1] Physical scientist, Division of International Activities.

[2] Where necessary values have been converted from West German marks (DM) to U.S. dollars at the rate of DM 4 = US$1.

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Table 1.—Federal Republic of Germany: Employment and turnover in the mineral industry

	Average 1968 employment (thousand persons)	Turnover (million dollars)			
		1967		1968	
		Domestic	Foreign	Domestic	Foreign
MINES					
Iron	5	38	2	39	--
Nonferrous metals	4	24	3	26	3
Potash and salt	16	146	49	155	55
Other nonmetallic minerals	2	8	4	10	4
Coal	272	1,227	417	1,317	447
Lignite	28	239	14	238	13
Peat	4	27	4	27	4
Oil and gas	7	165	2	206	2
Total	338	1,874	495	2,018	528
QUARRIES					
Stone	29	298	4	328	4
Sand and gravel	14	192	10	221	11
Slate, clays, other	7	44	8	49	9
Cement	20	459	15	449	14
Refractories	15	109	33	134	33
Lime, gypsum, chalk	15	196	11	202	22
Limestone, sandstone	6	96	--	108	--
Pumice	7	101	8	107	1
Total	113	1,495	89	1,598	94
PROCESSING PLANTS					
Iron and steel	322	8,495	1,517	4,377	1,299
Nonferrous plants	85	1,228	396	1,622	375
Petroleum refineries	33	8,492	132	4,406	150
Coal chemicals	4	61	19	74	19
Total	444	8,276	2,064	10,479	1,843
Grand total	895	11,645	2,648	14,095	2,465

Government measures instituted in 1965 to assure domestic coal a market share in domestic power production of approximately 50 percent until the end of 1970 have proved effective. However, the Ministry of Economics has not recommended extending these measures beyond their terminal date of 1971.

In petroleum, the Government worked on a plan to create an all German Unified Oil Supply Company and action to prevent the takeover of Gelsenkirchener Bergwerks A.G. (GBAG) by foreign capital. (See Petroleum.)

The influence of the 4-percent tax on exports and a corresponding rebate on imports had not become apparent by year-end because these measures were not introduced until November. It was felt that importers of nonferrous metals such as copper and tin would pass on the price reduction to consumers. Price reductions would be less for nonferrous metals for which the economy was less dependent on imports. Exporters would in many cases absorb most of the tax. For the steel industry the cost was estimated at $15 million on the export side because it was felt that owing to intense competition, the industry would absorb the 4-percent tax. The saving to the steel industry in the domestic market was estimated at $150 million.[3]

The Government and mining circles paid increasing attention to mineral raw materials supply for West German industry. Better information and documentation on world mineral resources, investment in foreign mineral projects, and Government organizations to meet these objectives were problems receiving consideration.

[3] The Economist. V. 229, No. 6539, Dec. 21, 1968, p. 60.

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PRODUCTION

The index of industrial production rose from 117.4 in 1967 to 131.2 in 1968 (1962=100). For mining the increase was much more modest, but for ferrous and nonferrous metals the increase in the production index exceeded that of the industry as a whole. In nonferrous semimanufactures, aluminum led with a 25-percent increase followed by copper, 16 percent. There was a continued structural change in the nonferrous semimanufactures industry with the objectives of rationalization and improving the competitive position. While the trend in coal production was reversed with a small increase in production, the decline in iron ore mining continued. The index for nonmetallic minerals and quarry products generally increased.

Industry sector	Index of production (1962=100)		Change (percent)
	1967	1968	
Mining	90.0	93.5	3.9
Coal	83.5	85.2	2.0
Metal ore mining	83.5	85.2	2.0
Iron	53.5	48.3	—9.7
Other	121.3	120.2	—.9
Potash and salt	120.3	129.7	7.8
Crude oil and gas	148.9	171.2	15.0
Iron and steel	112.4	128.8	14.5
Nonferrous metals	121.6	141.1	16.0
Petroleum refined	171.7	190.3	10.8
Stone and earth industries	113.5	118.7	4.6

Table 2.—Federal Republic of Germany: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, gross weight	4,156	3,898	3,667	2,284	NA
Alumina, gross weight—thousand tons	612	657	701	741	742
Metal:					
Primary—do	220	234	244	253	257
Secondary:					
Unalloyed—do	19	20	20	21	28
Alloyed—do	169	183	177	165	204
Semimanufactures—do	316	319	366	381	475
Crude castings—do	159	179	169	145	183
Arsenic (exports of arsenic acid)	38	71	377	104	NA
Bismuth	175	•125	•75	NA	•150
Cadmium	320	328	356	399	342
Cobalt	1,445	1,356	1,109	883	•800
Copper:					
Mine output, metal content	1,596	1,074	1,257	r 1,190	1,388
Metal:					
Blister:					
Primary—thousand tons	68	74	70	73	NA
Secondary—do	34	37	50	49	NA
Refined, including secondary:					
Electrolytic—do	232	247	255	267	304
Fire, refined—do	104	110	120	116	132
Alloys—do	39	42	33	31	36
Semimanufactures—do	760	769	684	685	794
Gold (smelter)—thousand troy ounces	109	80	102	74	85
Iron and steel:					
Iron ore and concentrate—thousand tons	11,613	10,847	9,467	8,553	7,714
Pig iron—do	26,895	26,710	25,117	27,112	29,977
Blast furnace ferromanganese and spiegeleisen—do	287	280	296	254	328
Electric furnace ferroalloys—do	131	NA	148	NA	NA
Steel ingots and castings—do	37,339	36,821	35,316	36,744	41,159
Of which castings—do	637	650	577	526	633
Steel semimanufactures—do	24,953	24,837	24,244	24,922	28,697
Lead:					
Mine output, metal content—do	49	50	56	59	52
Metal, unalloyed:					
Primary—do	108	104	110	136	120
Secondary—do	116	123	138	153	153
Alloys, unwrought—do	21	21	22	19	26
Semimanufactures and castings—do	57	55	56	56	56

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS—Continued					
Magnesium metal and alloys, including secondary:					
Unwrought	3,141	2,187	1,516	2,236	2,560
Castings	38,499	37,994	36,472	28,769	37,769
Mercury—76-pound flasks	1,740	2,176	2,030	NA	• 2,350
Molybdenum	208	262	• 230	162	• 220
Nickel, including secondary [1]	761	305	318	300	NA
Platinum—troy ounces	2,186	1,479	1,190	9,982	9,600
Silver:					
Mine output, metal content—thousand troy ounces	2,063	2,022	2,018	2,042	• 2,000
Metal, including secondary—do	11,580	10,409	13,877	16,480	21,918
Tin metal, including secondary:					
Refined unwrought—long tons	2,274	2,505	2,473	r 2,590	2,475
Alloys, unwrought and solder—do	19,453	20,975	22,041	21,716	48,394
Tungsten	649	825	689	518	798
Zinc:					
In zinc ore—thousand tons	96	95	98	107	110
In pyrite—do	15	14	8	8	7
Metal, unwrought, unalloyed:					
Primary—thousand tons	107	108	123	103	122
Secondary—do	69	81	92	84	81
Alloys—do	59	63	63	61	79
Semimanufactures—do	85	83	74	74	73
Castings—do	45	49	48	40	54
NONMETALS					
Barite (marketable)—thousand tons	467	469	451	r 410	456
Bromine and bromine compounds	2,286	2,945	r 2,101	r r 2,310	r 2,500
Cement:					
Portland—thousand tons	24,789	25,435	25,782	23,662	25,319
Iron portland and blast furnace slag—thousand tons	7,881	7,865	8,089	7,004	7,222
Other cement and mortar—do	962	833	867	841	902
Chalk—do	94	100	109	108	86
Clays:					
Fire clay (exclusive of Klebsand)—do	4,370	4,678	4,822	3,700	NA
Kaolin (marketable)—do	409	400	407	404	360
Bleaching—do	399	414	415	369	NA
Other (Schieferton)—do	89	87	64	67	NA
Corundum, artificial—do	64	75	74	71	78
Diatomaceous and similar earths—do	106	r 115	r 89	r 89	107
Feldspar—do	305	318	290	r 266	270
Fertilizers:					
Potash:					
Crude (gross weight)—do	20,588	22,209	21,483	19,850	20,187
Crude, K_2O content—do	2,553	2,740	2,645	2,460	2,561
Marketable, K_2O content:					
Crude—do	47	43	34	33	34
Chemically processed—do	2,154	2,341	2,256	2,097	2,186
Manufactured fertilizers:					
Nitrogenous:					
Single	979	1,050	1,115	1,153	1,170
Mixed	286	311	334	410	397
Phosphatic, P_2O_5 content:					
Single	610	639	600	561	501
Of which Thomas slag	436	433	394	381	340
Mixed	300	323	333	413	404
Fluorspar—thousand tons	90	83	85	98	102
Graphite—do	13	14	13	r 12	NA
Gypsum—do	1,278	1,299	1,316	1,116	1,100
Iodine, elemental and compound	119	NA	(3)	(3)	(3)
Lime:					
Burnt, hydraulic, and burnt dolomite—thousand tons	10,814	10,627	10,401	10,142	10,634
Other, ground—do	2,918	3,153	3,231	3,083	3,713
Mica	8	12	-------	-------	-------
Pigments, natural mineral—thousand tons	17	20	21	9	7
Pumice:					
Crude and washed—do	10,321	9,333	9,660	7,898	6,712
Marketable—do	5,821	5,096	5,390	4,181	3,562
Pyrite, marketable:					
Gross weight—do	424	439	450	556	615
Sulfur content—do	187	197	206	235	259
Quartz, quartzite, glass sand:					
Quartzite—do	276	281	267	r 210	NA
Quartz sand (ground)—do	904	851	809	733	938
Quartz sand (unground) and glass sand—thousand tons	4,870	5,127	5,154	4,806	4,947

See footnotes at end of table.

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Table 2.—Federal Republic of Germany: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS—Continued					
Salt:					
Rock (marketable)—thousand tons	5,404	5,105	5,122	r 5,165	7,540
Other (marketable)—do	950	1,597	1,782	1,742	
Stone, sand and gravel, n.e.s.:					
Dimension stone—thousand cubic meters	249	249	249	241	219
Limestone, industrial—thousand tons	54,585	52,754	55,081	52,380	54,391
Crushed and broken [3]—do	85,847	87,608	93,158	90,847	99,500
Slate:[4]					
Roofing for office and industry—do	43	38	34	30	28
Splittings and ground—do	82	86	85	76	77
Basalt lava and lava sand—do	5,212	5,820	5,975	5,881	NA
Calcite—do	42	46	34	35	NA
Grinding and whetstone—cubic meters	518	447	363	270	271
Printing stone—thousand cubic meters	44	42	43	40	33
Trass and tuff—thousand tons	4	4	4	3	NA
Industrial sands:					
Molding sand—do	879	930	1,067	761	1,021
Other (Klebsand)—do	177	159	155	129	
Sand and gravel—do	156,370	161,304	166,374	161,335	176,000
Sulfur, elemental byproduct—do	78	77	80	105	127
Talc, including talc schist—do	30	31	31	r 33	e 42
MINERAL FUELS AND RELATED MATERIALS					
Carbon black [3]	122	125	140	135	e 175
Coal, bituminous and anthracite—thousand tons	142,201	135,077	125,970	112,043	112,012
Coal briquets—do	5,409	4,544	4,005	3,578	3,705
Lignite—do	110,945	101,906	98,088	96,766	101,516
Lignite briquets—do	15,356	12,682	11,829	11,063	10,357
Pech coal—do	1,869	1,735	1,160	890	884
Coke:					
At mines—do	37,394	37,903	34,990	30,652	31,872
At steelworks—do	5,956	5,391	r 4,901	r 4,520	4,295
At gasworks—do	4,912	4,153	3,576	2,869	2,825
From lignite—do	596	578	543	394	
Peat (for fuel use only)—do	701	439	475	320	435
Gas:[5]					
Natural (associated and unassociated), refinery, and gas from oil, tar and naphtha—million cubic meters	15,279	19,360	r 22,455	27,342	NA
Blast furnace gas—do	14,840	14,005	12,230	12,807	NA
Generator and water gas—do	4,309	2,987	r 2,438	1,692	NA
Coke oven gas—do	22,607	22,045	20,086	17,692	NA
Other—do	696	729	r 850	734	NA
Total—do	57,731	59,126	r 58,059	60,267	NA
Natural gas:					
Nonassociated (1,000 cubic meters not converted to standard calorific value)	1,456,815	2,220,727	2,814,853	3,713,763	5,785,767
Associated—do	510,307	556,913	576,781	624,280	NA
Petroleum:					
Crude—thousand tons	7,673	7,884	7,868	7,927	7,982
Refinery products:					
Liquefied petroleum gas—do	1,380	1,476	1,605	1,743	1,822
Motor gasoline—do	9,000	9,785	10,324	10,743	11,474
Naphtha—do	1,304	1,606	2,164	2,660	4,396
Other gasolines—do	247	238	239	212	240
Jet fuel and kerosine—do	677	686	819	1,002	1,185
Diesel oil—do	6,788	6,910	8,122	8,821	9,173
Fuel oil [6]—do	31,694	37,509	42,802	44,711	50,402
Lubricants—do	600	608	608	668	827
Greases—do	22	24	22	18	NA
Bitumen—do	2,821	3,235	3,503	3,814	4,344
Petroleum coke—do	444	422	451	454	572
Refinery gas—do	1,880	2,542	3,143	3,684	4,335
Other—do	414	517	637	741	890
Total—do	57,271	65,558	74,439	78,771	89,660

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Primary nickel and nickel contained in ferronickel, monel metal and nickel oxide directly used by the steel industry.

[2] For 1966, 1967 and 1968 bromine figures include iodine and fluorine.

[3] Includes West Berlin.

[4] Exclusive of slate recovered from mine dumps.

[5] All volumes converted to 4,800 kilocalories per cubic meter.

[6] Includes distillates used as heating oil.

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TRADE

Imports and exports of mineral commodities in 1968 constituted 28.4 and 15.5 percent, respectively, of all imports and exports of West Germany by value as shown in the following tabulation:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports: [1]			
1966	r 3,551	r 20,157	r 17.6
1967	r 3,548	21,761	r 16.3
1968	3,869	24,888	15.5
Imports:			
1966	4,572	r 18,167	25.1
1967	r 4,648	17,545	26.4
1968	5,783	20,295	28.4
Trade balance:			
1966	r −1,021	r 1,990	XX
1967	r −1,100	4,216	XX
1968	−1,914	4,598	XX

r Revised. XX Not applicable.
[1] Excludes coal and petroleum chemicals; 1966 figures exclude gold.

Among major groups of mineral commodity exports, iron and steel products ranked first in value, solid fuels second, and nonferrous base metals, third. Among mineral commodity import groups, petroleum and its products ranked first, followed by nonferrous metals. Details on total tonnage and value of the 1968 mineral trade by major groups and similar revised data for 1967 appear in table 3.

Table 3.—Federal Republic of Germany: Mineral and metal trade by major commodity groups

	1967				1968			
	Imports		Exports		Imports		Exports	
	Quantity (thousand metric tons)	Value (millions)	Quantity (thousand metric tons)	Value (millions)	Quantity (thousand metric tons)	Value (millions)	Quantity (thousand metric tons)	Value (millions)
METALS								
Ores and concentrates:								
Iron ore, including pyrite cinder	33,474	$322	384	$3	41,434	$381	40	$1
Other	3,694	180	104	11	4,473	223	142	18
Ashes and residues	2,002	33	1,165	17	1,868	28	1,766	17
Scrap:								
Iron and steel	1,105	44	2,170	74	1,644	65	1,847	64
Nonferrous	148	101	76	38	224	72	61	19
Primary forms and semimanufactures:								
Pig iron and ferroalloys	414	61	1,388	83	594	87	955	56
Steel	5,366	673	12,023	1,675	8,049	1,004	12,866	1,752
Nonferrous base metals [1]	1,090	900	525	512	1,378	1,146	505	542
Precious metals [2]	2	320	1	76	3	356	1	147
Metallic oxides, including alumina	98	22	331	71	91	23	322	63
NONMETALS								
Cement and clinker	396	6	1,286	18	440	7	1,384	20
Fertilizer materials, crude and manufactured	3,786	71	4,327	157	4,348	79	6,381	195
Other crude nonmetals [3]	17,499	168	21,504	75	20,626	259	24,241	176
MINERAL FUELS								
Solid	8,582	115	26,619	488	7,454	95	30,983	544
Liquid and gaseous, including asphalt	92,116	1,632	8,899	253	106,815	1,958	9,900	255
Total	169,772	4,648	80,752	3,551	199,441	5,783	91,844	3,869

[1] Includes metalloids such as arsenic, tellurium, selenium, phosphorus, and silicon, as well as mercury, alkali metals, and rare-earth metals.
[2] Includes ores, concentrates, waste and scrap of precious metals, which account for most of the tonnage but for a relatively small part of the value.
[3] Includes refractory brick and lime.

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Table 4.—Federal Republic of Germany: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 destinations	
			EEC [1]	Principal destinations
METALS				
Aluminum:				
Bauxite	4,437	2,526	1,603	Belgium-Luxembourg 1,199.
Alumina	92,129	113,790	3,112	Austria 83,686; Poland 17,609.
Aluminum hydroxide	38,383	42,871	17,532	Netherlands 9,786; Belgium-Luxembourg 6,963; Finland 6,224; Sweden 5,469.
Metal and alloys:				
Scrap	6,858	10,662	10,651	Italy 9,065; Netherlands 1,033.
Unwrought	21,488	21,802	19,003	Belgium-Luxembourg 6,132; Italy 5,578; Netherlands 4,067.
Semimanufactures	80,290	96,202	48,275	France 16,030; Netherlands 12,935; Belgium-Luxembourg 10,879.
Antimony:				
Oxides	267	242	13	United States 174
Metal, all forms	208	189	98	France 96; Portugal 42.
Arsenic oxides	377	98	------	India 30.
Bismuth metal, all forms	100	128	100	Netherlands 80.
Cadmium: Metal, all forms	139	147	104	Belgium-Luxembourg 46; France 26.
Chromium:				
Chromite	1,197	1,404	689	France 490; Switzerland 405.
Oxides and hydroxides	6,229	6,748	NA	NA.
Metal, all forms	80	99	37	United States 55; Italy 18.
Cobalt:				
Oxides and hydroxides	57	39	9	Bulgaria 13; Italy 7.
Metal, all forms	448	192	17	Japan 71; United States 46; Spain 38.
Copper:				
Ore, concentrate and matte	3,245	1,387	804	Belgium-Luxembourg 804; Poland 583.
Oxides and hydroxides	1,064	1,492	650	Netherlands 380; United States 236; France 175.
Metal and alloys:				
Scrap	44,060	35,340	29,214	Italy 12,942; Belgium-Luxembourg 8,229; Netherlands 5,596.
Unwrought:				
Blister	2,179	3,840	2,075	Spain 1,100; France 958.
Refined, unalloyed	150,002	158,587	30,615	United States 86,485; United Kingdom 22,523.
Master alloys	253	165	33	United Kingdom 103; Belgium-Luxembourg 23.
Other alloys	2,287	2,813	2,030	Italy 1,133; Belgium-Luxembourg 515; Switzerland 380.
Semimanufactures	91,869	99,775	29,125	United States 26,893; Netherlands 12,924.
Gold and alloys:				
Bullion, thousand troy ounces	300	358	109	Spain 64; Italy 48; Chile 42; Switzerland 41.
Wrought, do	236	201	19	Austria 121; Denmark 27.
Iron and steel:				
Ore and concentrate:				
Roasted pyrites, thousand tons	62	51	44	France 30; Belgium-Luxembourg 14.
Other, do	300	332	38	Austria 288.
Scrap, do	2,016	2,170	2,125	Italy 1,998.
Pig iron, including cast iron, do	587	1,296	488	Japan 648; Italy 383.
Sponge iron, powder and shot, do	10	9	4	Netherlands 2; Switzerland 2; Austria 1.
Spiegeleisen, do	12	12	11	Belgium-Luxembourg 8; France 3.
Ferroalloys:				
Ferro-manganese, thousand tons	92	40	13	United States 18; France 8.
Other, do	28	30	11	United States 9; Italy 4; Netherlands 3; Belgium-Luxembourg 3.
Primary forms:				
Ingots, do	124	124	123	France 84; Belgium-Luxembourg 25.
Blooms, billets and slabs, do	847	1,285	561	France 316; Spain 237; Argentina 179; Italy 152.
Coils for rerolling, do	717	1,276	667	United States 493; Italy 312; France 192.
Semimanufactures:				
Wire rod, do	503	595	206	United States 189; France 106; Netherlands 58.
Other bars and rods, do	1,222	1,402	655	France 397; United States 214; Netherlands 159.
Sections, do	1,291	1,374	534	France 245; United States 225; Netherlands 167.

See footnotes at end of table.

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Table 4.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 destinations	
			EEC [1]	Principal destinations
METALS—Continued				
Iron and steel—Continued				
Plates and sheets:				
Heavy----thousand tons--	1,544	1,482	656	France 383; mainland China 152.
Medium----------do----	150	163	50	Mainland China 44; France 19.
Thin uncoated-----do----	950	1,382	381	U.S.S.R. 259; United States 255.
Tinned----------do----	150	185	45	Spain 30; France 18.
Other coated-------do----	166	286	52	United States 119; mainland China 22.
Hoop and strip---------do----	452	502	246	Netherlands 118; France 91.
Railway track and accessories. do----	151	141	61	Italy 24; Angola 14; Switzerland 14.
Wire----------do----	215	237	86	France 48; United States 25; Netherlands 23.
Tubes, pipes, fittings----do----	1,171	1,558	540	Netherlands 317; mainland China 124.
Castings and forgings, rough. do----	24	32	11	Switzerland 5; Norway 4; Netherlands 4; Belgium-Luxembourg 4.
Lead:				
Ore and concentrate----------	8,932	5,637	5,637	Belgium-Luxembourg 3,708; France 1,928.
Oxides----------	6,133	7,486	3,276	Netherlands 2,311; United States 947.
Metal and alloys:				
Scrap----------	26,031	20,172	20,123	Italy 14,553; Belgium-Luxembourg 2,601.
Unwrought----------	41,553	80,350	19,271	United States 52,161.
Semimanufactures----------	8,817	7,183	2,972	Belgium-Luxembourg 1,863; Finland 619.
Magnesium:				
Oxides and hydroxides----------	121	1,988	563	Italy 355; Austria 283; Sweden 234.
Metal and alloys:				
Scrap----------	966	259	80	United States 140; Italy 52; Austria 30.
Unwrought and semimanufacture.	159	177	66	Austria 41; Sweden 35; Italy 17.
Manganese:				
Ore and concentrate----------	5,900	611	454	Netherlands 185; Austria 90.
Oxides and peroxides----------	121	280	NA	NA.
Metal, all forms----------	1,484	12	4	NA.
Mercury----------76-pound flasks--	1,653	1,149	406	Netherlands 334; United States 203.
Molybdenum metal, all forms----------	94	80	38	France 34; Japan 11.
Nickel:				
Matte and speiss----------	320	223	11	Canada 212.
Metal and alloys:				
Scrap----------	1,813	2,327	762	United Kingdom 861; Netherlands 558; Sweden 522.
Unwrought----------	478	510	367	Italy 185; Netherlands 98; France 54.
Semimanufactures----------	6,060	6,727	2,600	Netherlands 1,208; France 582.
Platinum-group metals, all forms. thousand troy ounces--	365	391	186	Italy 127; Japan 46.
Silicon----------	20	40	11	United States 18; Netherlands 5.
Silver:				
Ashes, residues, scrap----------	11	8	8	Belgium-Luxembourg 6.
Metal and alloys:				
Unwrought. thousand troy ounces--	14,416	13,579	7,931	Italy 7,181; Czechoslovakia 1,229.
Semimanufactures------do----	9,237	9,902	4,084	Italy 2,355; Switzerland 1,378; Sweden 1,158.
Tantalum metal, all forms----------	10	13	5	France 4; Japan 2; Finland 2.
Tin:				
Ore and concentrate----long tons--	58	46	------	All to the United Kingdom.
Oxides----------do----	314	366	113	Poland 62; Italy 47; Netherlands 38.
Metals and alloys:				
Scrap----------do----	31	81	68	Netherlands 68.
Unwrought----------do----	1,632	1,995	1,287	France 755; Netherlands 341.
Semimanufactures------do----	170	199	59	Netherlands 29; Austria 22; Norway 22; Switzerland 21.
Titanium:				
Ores (ilmenite and rutile). thousand tons--	629	165	1	Yugoslavia 140.
Oxides----------	29,327	27,111	11,551	Belgium-Luxembourg 5,095; United States 4,036.
Metal, all forms----------	205	363	260	France 186; United States 48.
Tungsten:				
Ore and concentrate----------	141	178	12	United Kingdom 166.
Metal, all forms----------	322	338	35	United States 104; Switzerland 62; Sweden 46.
Vanadium metal, all forms--kilograms--	100	------	------	

See footnotes at end of table.

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Table 4.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 destinations	
			EEC [1]	Principal destinations
METALS—Continued				
Zinc:				
Ore and concentrate	50,800	90,395	47,586	France 23,479; United States 17,452; Belgium-Luxembourg 16,106; Poland 15,400.
Oxides and peroxides	9,196	9,371	1,562	Turkey 1,187; Sweden 854.
Metal and alloys:				
Scrap	7,643	4,719	4,719	Italy 4,028.
Zinc dust (blue powder)	3,010	2,858	2,396	Netherlands 1,545; Switzerland 342.
Unwrought	27,981	28,614	14,510	Italy 9 258; Switzerland 5,837.
Semimanufactures	6,122	6,672	1,951	France 1,194; Sweden 733.
Zirconium metal, all forms	5	15	1	Sweden 11.
Other:				
Metalliferous nonferrous waste, n.e.s.	104,384	128,536	109,150	Belgium-Luxembourg 56,320; Netherlands 40,040.
Oxides and hydroxides of barium and strontium.	1,126	1,315	857	Belgium-Luxembourg 548; United Kingdom 184.
Metals and metalloids:				
Alkali, alkaline earth, rare-earth metals.	4,577	5,705	NA	NA.
Arsenic and tellurium	7	8	4	Italy 2; Netherlands 1.
Boron	3	6	------	All to United States.
Selenium and phosphorus	8,785	8,415	NA	NA.
Uranium and thorium—kilograms	600	100	NA	NA.
Ferrocerium and other pyrophoric alloys.	197	97	NA	NA.
Miscellaneous—kilograms	3,400	3,100	400	Japan 1,400; United States 600.
NONMETALS				
Abrasives:				
Natural:				
Industrial diamond—thousand carats	75	165	105	Belgium-Luxembourg 50; Netherlands 45; mainland China 40.
Dust and powder of gem stones, including synthetic stones—do	85	71	30	United States 22; Italy 19.
Diatomite and other siliceous earths.	5,063	3,616	1,367	Austria 918; Netherlands 461; Italy 414.
Pumice and other natural abrasives—thousand tons	563	560	557	Netherlands 352; Belgium-Luxembourg 197.
Manufactured (grinding stones).	7,920	6,014	3,154	Italy 975; France 920; Netherlands 746; Switzerland 633.
Artificial:				
Corundum	24,835	27,299	7,734	Italy 2,844; Sweden 2,785.
Silicon carbide	7,311	7,423	NA	NA.
Boron materials:				
Crude	191	214	174	Netherlands 161.
Boric oxide and acid	51	51	4	Yugoslavia 12.
Cement: Portland, hydraulic, and other types—thousand tons	1,163	1,236	1,039	Netherlands 1,013.
Chalk, crude	4,679	7,523	6,714	Netherlands 6,599.
Clays and clay products:				
Crude:				
Kaolin—thousand tons	66	76	44	Italy 25; Austria 14.
Fire clay—do	349	333	250	Netherlands 80; Italy 75; France 62.
Andalusite, dinas and other.	650	388	366	Netherlands 246; Belgium-Luxembourg 71.
Products: Construction materials:				
Refractory—thousand tons	351	289	139	Belgium-Luxembourg 49; France 45.
Nonrefractory—do	314	345	238	France 123; Netherlands 69; Austria 38; Belgium-Luxembourg 37.
Diamonds and other gem stones:				
Diamond, except powder, dust and other industrial:				
Crude or rough cut—thousand carats	45	45	NA	NA.
Other worked—do	130	120	75	Belgium-Luxembourg 60.
Other precious or semiprecious:				
Crude or rough cut, natural	82	53	19	Switzerland 12; France 10; Italy 7.
Worked, natural—kilograms	25,401	25,718	5,259	United States 9,899; France 3,473.
Synthetic—do	7,025	6,266	435	United States 3,026; Italy 279.
Dolomite, crude and calcined	99,916	85,920	78,616	Netherlands 46,789; Belgium-Luxembourg 16,354; France 15,341.
Feldspar	11,885	12,082	10,028	Belgium-Luxembourg 3,127; France 3,079; Netherlands 2,067.

See footnotes at end of table.

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Table 4.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 destinations	
			EEC [1]	Principal destinations
NONMETALS—Continued				
Fertilizer materials:				
Crude, natural:				
Phosphatic	42,511	50,069	------	Austria 48,414.
Potassic	54,200	53,075	44,691	Netherlands 25,681; Belgium-Luxembourg 19,010.
Organic, including guano	858	3,406	3,219	Netherlands 3,188.
Manufactured:				
Nitrogenous—thousand tons	1,398	1,594	177	Mainland China 470, United Kingdom 148.
Phosphatic:				
Basic slag—do	224	203	150	France 129; Austria 27.
Other—do	35	11	------	Chile 3; Denmark 2; Gambia 2; Iran 2.
Potassic—do	1,688	1,623	373	United States 214; Denmark 180; Netherlands 170; Belgium-Luxembourg 167.
Mixed—do	618	761	167	Denmark 107; Yugoslavia 100; France 95.
Ammonia, anhydrous—do	42	27	20	Belgium-Luxembourg 17; Switzerland 4.
Fluorspar	11,222	9,403	1,781	Austria 5,046.
Graphite, natural, crude or ground	7,178	7,675	2,821	Italy 2,164; United States 1,650.
Gypsum and plasters—thousand tons	360	296	218	Netherlands 170; Switzerland 31; Belgium-Luxembourg 31.
Lime, hydraulic and slaked—do	352	356	346	Netherlands 322.
Magnesite	6,623	8,963	7,079	France 4,186; Belgium-Luxembourg 1,482; Netherlands 1,374.
Mica:				
Crude, including splitting and waste	612	130	77	France 65; United States 29.
Worked, including agglomerated splittings.	91	553	10	Switzerland 293; Iran 68.
Pigments:				
Earth colors, natural	4,384	6,269	3,649	Netherlands 1,933; Belgium-Luxembourg 1,059.
Iron oxides and hydroxides. thousand tons	82	87	28	United Kingdom 13; France 12.
Pyrite—gross weight	267	176	49	United Kingdom 51; France 43; Austria 32.
Salt—thousand tons	945	1,014	506	Belgium-Luxembourg 470; Sweden 252.
Sodium and potassium compounds, n.e.s.:				
Caustic soda—thousand tons	184	263	125	Netherlands 92; United States 39.
Caustic potash, sodium and potassium peroxides.	11,485	10,755	1,566	U.S.S.R. 2,800; Switzerland 1,208; Sweden 1,147; United States 1,143.
Stone, sand and gravel:				
Dimension stone:				
Unworked and partly worked:				
Marble and other calcareous. thousand tons	3	3	2	Netherlands 1.
Slate—thousand tons	140	21	16	Netherlands 12.
Granite, porphyry, other. do	365	395	369	Netherlands 335.
Worked, all types including paving blocks. do	33	46	43	Netherlands 29; Belgium-Luxembourg 10.
Dolomite, crude and calcined—do	100	86	79	Netherlands 47; Belgium-Luxembourg 16; France 15.
Gravel and crushed stone—do	9,327	10,621	9,730	Netherlands 7,088; Belgium-Luxembourg 2,619.
Limestone, except dimension—do	57	74	72	Netherlands 69.
Quartz and quartzite, crude and partly worked. do	41	39	17	Austria 14; Netherlands 7; Belgium-Luxembourg 7.
Sand, excluding metal-bearing. do	4,624	5,432	5,138	Netherlands 4,180; Belgium-Luxembourg 829.
Sulfur:				
Elemental including colloidal and precipitated.	66,377	74,132	4,443	Hungary 12,149; Austria 6,585; Rumania 6,378.
Other elemental	1,156	1,232	137	United Kingdom 254; Republic of South Africa 121; Sweden 121.
Sulfur dioxide	2,809	11,839	7,351	Belgium-Luxembourg 5,661; Sweden 2,412.
Sulfuric acid	97,586	61,037	31,468	Belgium-Luxembourg 18,446; United Kingdom 15,881.

See footnotes at end of table.

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Table 4.—Federal Republic of Germany: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 destinations	
			EEC [1]	Principal destinations
NONMETALS—Continued				
Talc, soapstone, steatite	1,146	1,540	257	Denmark 441; Switzerland 243.
Vermiculite and mineral wool	96	107	10	Austria 87.
Other:				
Slag, dross and waste, not metal bearing. thousand tons	592	867	862	Netherlands 563; France 241.
Other do	164	165	155	Netherlands 114; Greece 45.
Bromine, fluorine, iodine	725	120	56	Netherlands 55; Spain 48.
MINERAL FUELS				
Asphalt and bitumen, natural	861	1,351	143	Switzerland 592; Austria 558.
Coal, coke, briquets:				
Anthracite and bituminous coal. thousand tons	15,797	17,443	15,579	France 5,775; Netherlands 4,168; Belgium-Luxembourg 2,949.
Bituminous coal briquets do	218	172	155	Italy 62; France 44; Belgium-Luxembourg 25.
Lignite and lignite briquets do	1,234	1,158	845	France 341; Austria 211; Italy 173.
Peat and peat briquets do	200	216	148	Netherlands 110; Switzerland 36.
Coke and semicoke from coal, peat, and lignite. do	8,309	7,635	5,568	Belgium-Luxembourg 2,604; France 2,571.
Carbon black	30,662	36,402	18,575	France 6,440; Netherlands 5,229; Belgium-Luxembourg 4,694.
Gas, natural and manufactured. thousand tons	309	333	257	France 117; Netherlands 74; Denmark 66.
Hydrogen and rare gases	491	1,793	NA	NA.
Petroleum:				
Crude and partly refined oil. thousand tons	140	82	------	All to Austria.
Refinery products:				
Gasoline do	1,437	1,114	293	United Kingdom 281; Switzerland 247; Netherlands 250.
Kerosine do	517	622	6	Switzerland 25; bunkers 573.
Distillate fuel oil do	1,086	1,395	336	Switzerland 715; Belgium-Luxembourg 130; bunkers 252.
Residual fuel oil do	3,638	3,956	2,090	Netherlands 1,711; Belgium-Luxembourg 336; bunkers 1,126.
Lubricants do	170	211	100	Belgium-Luxembourg 43; United Kingdom 36; Netherlands 27.
Mineral jelly and wax do	67	69	19	Italy 8; Denmark 6; Netherlands 6.
Nonlubricating oils, n.e.s. do	82	167	69	United Kingdom 66; Belgium-Luxembourg 52.
Pitch and pitch coke do	248	271	182	France 152; Netherlands 27.
Petroleum coke do	153	151	73	Netherlands 47; Switzerland 27; Austria 15.
Bitumen and other residues. do	237	262	38	Switzerland 77; Denmark 57; Austria 44.
Bituminous mixtures, n.e.s. do	25	32	12	Denmark 12; Netherlands 7.
Tar, mineral, and other crude chemicals from coal, petroleum and natural gas distillation, n.e.s. do	156,132	249	114	Netherlands 56; United States 43; United Kingdom 36; Switzerland 35.

NA Not available.
[1] Belgium, France, Italy, Luxembourg, and the Netherlands.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources: EEC [1]	1967 sources: Principal sources
METALS				
Aluminum:				
Bauxite—thousand tons	1,882	1,802	86	Yugoslavia 569; Australia 356; Greece 327.
Alumina	51,557	65,523	663	Guinea 49,141; Surinam 14,348.
Aluminum hydroxide	1,325	1,690	180	United States 1,506.
Metal, including alloys, all forms:				
Scrap	50,848	49,719	15,245	Netherlands 8,317; France 3,908.
Unwrought	176,793	185,381	26,330	Norway 70,494; Austria 19,996.
Semimanufactures	38,625	38,755	29,392	France 12,062; Belgium-Luxembourg 8,520; Netherlands 6,470.
Antimony:				
Ore and concentrate	3,197	3,024	250	Thailand 1,645; Turkey 748.
Oxides	591	581	148	United Kingdom 169; U.S.S.R. 148; Belgium-Luxembourg 145.
Metal, all forms	2,777	2,402	126	Mainland China 1,755; Czechoslovakia 276.
Arsenic:				
Acid anhydride	1,169	1,075	1,035	Belgium-Luxembourg 705; France 320.
Metal and tellurium	51	52	1	Sweden 40; U.S.S.R. 10.
Bismuth metal, all forms	262	250	93	Netherlands 77.
Cadmium metal, all forms	1,149	1,189	704	Belgium-Luxembourg 463; Netherlands 154.
Chromium:				
Chromite	308,328	284,660	170	U.S.S.R. 132,420; Republic of South Africa 94,664; Turkey 33,634.
Oxide and hydroxide	127	159	7	Mainland China 89; U.S.S.R. 36.
Metal, all forms—kilograms	41,700	90,600	42,600	France 42,500.
Cobalt:				
Oxide and hydroxides	320	311	303	Belgium-Luxembourg 302.
Metal, all forms	734	571	298	Belgium-Luxembourg 248; Congo (Kinshasa) 171.
Columbium and tantalum:				
Ore and concentrate	1,405	1,019	------	Brazil 394; Canada 319; Nigeria 289.
Metal:				
Columbium	([3])	1	------	NA.
Tantalum	18	9	2	United States 4; Belgium-Luxembourg 1.
Copper:				
Ore and concentrate	136,764	132,342	------	Nicaragua 43,153; Chile 27,023; Cyprus 14,980; United States 14,400.
Matte	1,635	356	37	United Kingdom 285.
Copper sulfate	2,080	2,211	1,076	Switzerland 894; France 714; Belgium-Luxembourg 306.
Metal, including alloys:				
Scrap	78,306	83,337	47,070	France 20,259; Netherlands 19,019.
Unwrought:				
Blister	146,340	164,767	4,355	Chile 43,204; Republic of South Africa 42,257; Zambia 26,713; Peru 22,041.
Refined	265,252	272,208	61,147	Chile 88,853; Belgium-Luxembourg 58,798; Zambia 32,169.
Alloys	35,477	42,645	8,496	United Kingdom 21,536.
Masteralloys	949	849	89	United Kingdom 371; Switzerland 314.
Semimanufactures	56,794	33,448	25,937	Belgium-Luxembourg 15,375; Netherlands 4,706; France 4,674; Yugoslavia 3,444.
Gold:				
Ashes, residues and scrap—thousand troy ounces	2,228	1,714	49	Switzerland 1,337; Denmark 239.
Metal:				
Unwrought—do	3,850	5,526	1,195	Republic of South Africa 2,499; France 989; Switzerland 725.
Semimanufactures—do	10	17	1	Switzerland 8; United States 5; Austria 3.
Iron and steel:				
Ore and concentrate, exept roasted pyrite—thousand tons	31,268	31,861	4,279	Sweden 10,265; Liberia 6,160; Brazil 4,404; France 4,276.
Roasted pyrites—do	1,743	1,613	732	Spain 649; Italy 231; Belgium-Luxembourg 229.
Metal:				
Scrap—do	670	1,103	905	Netherlands 473; Belgium-Luxembourg 359.

See footnote at end of table.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources	
			EEC [1]	Principal sources
METALS—Continued				
Iron and steel—Continued				
Pig iron, including cast iron. thousand tons	174	139	84	Belgium-Luxembourg 33; France 31; Netherlands 19.
Powder and shot	17,454	17,014	5,645	Sweden 9,085; France 3,915.
Spiegeleisen	10,173	3,384	3,384	France 2,490; Belgium-Luxembourg 894.
Ferroalloys:				
Ferro-manganese. thousand tons	89	73	41	France 32; Norway 22.
Other do	176	182	22	Norway 74; Republic of South Africa 22.
Steel, primary forms:				
Ingots do	20	74	47	Netherlands 32; Poland 26
Blooms, billets and slabs. do	430	290	276	Belgium-Luxembourg 164; France 62.
Coil for rerolling do	588	624	118	Austria 319, U.S.S.R. 165.
Semimanufactures:				
Wire rod do	643	597	552	Belgium-Luxembourg 247; France 246.
Other bars and rods do	860	699	623	Belgium-Luxembourg 322; Italy 149; France 111.
Sections:				
Large do	364	323	308	Belgium-Luxembourg 199; France 103.
Small do	213	203	165	Belgium-Luxembourg 112; France 42.
Plates and sheets:				
Heavy plates do	471	506	332	Belgium-Luxembourg 198; France 87; Sweden 70.
Medium plates do	180	161	141	Belgium-Luxembourg 92; France 40.
Thin, uncoated do	1,232	1,172	1,062	France 425; Belgium-Luxembourg 397; Netherlands 154.
Coated:				
Tinned do	110	103	103	France 53; Belgium-Luxembourg 41.
Other do	82	92	83	Belgium-Luxembourg 53; France 29.
Hoop and strip do	347	309	289	Belgium-Luxembourg 182; France 62; Netherlands 40.
Railway track material do	13	10	7	Netherlands 3; Belgium-Luxembourg 3.
Wire (excluding wire rod). do	73	70	59	Belgium-Luxembourg 42; France 7.
Tubes, pipes, fittings do	181	125	78	Netherlands 36; Belgium-Luxembourg 27; Sweden 14.
Castings and forgings, rough. do	10	7	6	Belgium-Luxembourg 4; Italy 1.
Lead:				
Ore and concentrate	188,589	223,212	697	Canada 46,207; Sweden 37,063; Ireland 34,971; Peru 25,008.
Oxides	2,817	2,531	982	Mexico 590; Belgium-Luxembourg 524; Poland 495.
Metal and alloys:				
Scrap	1,596	2,622	1,873	Netherlands 1,585; Norway 662.
Unwrought	88,028	81,473	15,010	United Kingdom 29,594; Australia 15,760; Canada 11,416.
Semimanufactures	2,124	2,009	285	Netherlands 123; United Kingdom 103.
Magnesium:				
Oxide and hydroxide	2,077	1,713	489	United States 693; United Kingdom 504; France 449.
Scrap	207	676	258	Sweden 231; Netherlands 134.
Unwrought	35,654	32,106	1,958	Norway 20,931, United States 6,224.
Semimanufactures	162	138	35	Austria 68.
Manganese:				
Ores and concentrates. thousand tons	867	672	1	Republic of South Africa 348; Gabon 145; Congo (Kinshasa) 80.
Oxides	2,077	2,415	1,031	Japan 1,232; Belgium-Luxembourg 787.
Metal, all forms	1,860	2,658	953	France 953; Japan 552; Republic of South Africa 507.
Mercury 76-pound flasks	19,464	12,442	3,371	Spain 6,301; Italy 2,985.
Molybdenum:				
Oxides [2]	365	842	NA	United States 357; Republic of South Africa 157.
Metal, all forms	387	250	38	U.S.S.R. 103; Austria 98.

See footnotes at end of table.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources	
			EEC [1]	Principal sources
METALS—Continued				
Nickel:				
Ore and concentrate	5	243	------	All from United Kingdom.
Matte and speiss	6,166	4,042	168	Canada 3,243; United States 376.
Metal and alloys:				
Scrap	2,744	6,590	1,824	United States 3,080; Netherlands 880.
Unwrought	23,815	28,255	1,369	United Kingdom 9,396; Norway 5,019; Republic of South Africa 5,010.
Semimanufactures	1,764	1,907	612	United Kingdom 643; France 340; United States 263.
Platinum-group metals:				
Ashes, residues, scrap—kilograms	86,809	74,069	18,250	Czechoslovakia 29,669; Netherlands 12,574.
Metals, all forms—troy ounces	540,872	491,809	66,166	U.S.S.R. 196,859; United Kingdom 122,108; United States 68,867.
Selenium and phosphorus	2,435	NA	NA	NA.
Silicon	18,982	15,987	7,451	France 4,386; Norway 4,188; Italy 3,058.
Silver:				
Ashes, residues, scrap—kilograms	182,048	218,259	27,908	Sweden 77,401; Austria 29,532; United Kingdom 27,851.
Unwrought thousand troy ounces including alloys.	45,169	47,721	2,978	Mexico 13,445; Peru 8,620; United States 7,499.
Semimanufactures—do	953	671	167	Switzerland 419; Italy 93.
Thorium ore (monazite and other)	NA	45	21	Malaysia 24; Netherlands 21.
Tin:				
Ore and concentrate—long tons	7,378	8,250	------	Bolivia 8,160.
Oxides—do	138	93	93	Belgium-Luxembourg 49; France 43.
Metal, including alloys:				
Scrap—do	197	175	111	Netherlands 101.
Unwrought—do	12,894	12,162	7,527	Netherlands 6,147; Malaysia 1,720. Belgium-Luxembourg 1,342.
Semimanufactures—do	18	81	57	Netherlands 36; Belgium-Luxembourg 12.
Titanium:				
Ore and concentrate	371,637	374,394	------	Norway 210,495; Canada 141,972: Australia 17,443.
Oxides	3,121	2,477	2,170	Italy 879; Belgium-Luxembourg 738; Netherlands 324.
Metal, including alloys, all forms	947	1,193	------	United States 680; U.S.S.R. 263.
Tungsten:				
Ore and concentrate	5,312	4,482	33	Mainland China 2,234; Bolivia 862.
Metal, including alloys, all forms	529	625	128	United States 184; Sweden 170; Austria 115.
Uranium:				
Ore and concentrate	[3] 2,496	------	------	
Metal, including alloys, all forms. kilograms	17,600	13,100	1,900	United Kingdom 11,200.
Zinc:				
Ore and concentrate	164,682	149,952	488	Sweden 52,405; Canada 45,080; Finland 16,119.
Oxides	3,169	2,395	1,688	France 822; Netherlands 569.
Metal, including alloys:				
Scrap	624	652	208	Denmark 311; France 89; Netherlands 89.
Zinc dust	4,474	4,684	4,205	Belgium-Luxembourg 3,951.
Unwrought	126,800	141,881	86,265	Belgium-Luxembourg 61,789; Netherlands 16,504.
Semimanufactures	14,468	17,697	7,131	Yugoslavia 10,493; Belgium-Luxembourg 5,279.
Zirconium:				
Ore and concentrate	26,706	22,585	103	Australia 20,371; United Kingdom 1,057.
Metal, all forms—kilograms	34,400	49,900	16,300	United States 24,300; France 16,300.
Other:				
Ores and concentrates	3,472	975	1	Bolivia 872.
Ashes and residues containing nonferrous metals	88,490	129,725	29,046	Malaysia 17,251; Spain 15,257.
Metals and metalloids:				
Alkali, alkaline earth, rare earth metals.	79	110	93	France 90.
Ferrocerium and other pyrophoric alloys.	39	27	4	Austria 21.
Miscellaneous	8	3	1	Belgium-Luxembourg 1.

See footnotes at end of table.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources	
			EEC [1]	Principal sources
NONMETALS				
Abrasives:				
Natural:				
Industrial thousand carats diamond.	575	520	245	Belgium-Luxembourg 160; Republic of South Africa 120.
Dust and thousand carats powder of gem stones, including diamond.	1,320	1,433	780	Netherlands 405; Belgium-Luxembourg 375; United Kingdom 165.
Diatomite and other siliceous earths.	76,424	69,108	13,537	Denmark 50,409; France 13,285.
Pumice, emery, other natural abrasives.	80,221	74,961	70,073	Italy 69,422.
Manufactured (grinding stone)	2,738	2,550	1,036	Austria 566; Sweden 356; France 352.
Artificial:				
Artificial corundum	6,743	4,607	1,521	Austria 2,379; France 1,281.
Silicon carbide	8,122	8,101	1,375	Norway 6,352; Italy 1,210.
Asbestos:				
Crude or partially worked	169,414	125,798	13,194	Canada 62,499; U.S.S.R. 23,448; Italy 13,161.
Asbestos cement products	106,194	89,973	44,039	Belgium-Luxembourg 33,386; Sweden 18,852.
Asbestos manufactures, excluding friction materials.	7,726	5,893	2,200	United Kingdom 2,138; France 1,044; Netherlands 935; United States 607.
Barite and witherite	29,835	39,280	17,406	Mainland China 8,378.
Boron salts, natural	65,859	92,586	336	United States 82,535; Turkey 9,715.
Boric oxide and acid	11,181	9,079	5,859	France 5,138; United States 3,015.
Cement, hydraulic thousand tons	493	396	317	France 218; Belgium-Luxembourg 66; Poland 40.
Chalk do	117	110	91	France 83; Denmark 19.
Clays and clay products:				
Crude:				
China clay (kaolin) do	427	398	38	United Kingdom 289; France 38.
Fire clay do	160	157	44	Czechoslovakia 52; Republic of South Africa 46; France 34.
Andalusite, dinas, other. do	224	194	117	France 51; Netherlands 41; United States 27; Belgium-Luxembourg 23.
Products, construction materials:				
Building brick thousand tons	500	467	399	NA.
Other (roof tile, ceramic piping, etc.) do	258	263	172	Netherlands 72; Italy 57; Japan 36.
Refractory:				
Heat-insulating brick of diatomite and similar earths.	9,049	5,458	351	Denmark 4,853.
Brick, n.e.s	51,745	56,822	13,225	Austria 24,063; France 8,173.
Mortars	18,740	20,969	4,941	Ireland 10,632; Austria 3,407.
Cryolite and chiolite	2,778	1,605	------	All from Denmark.
Diamond, except powder, dust, and other industrial:				
Crude or rough thousand carats cut.	415	400	NA	NA.
Other worked do	225	150	90	Belgium-Luxembourg 70; Israel 35.
Other precious or semiprecious:				
Crude or rough cut, natural	1,221	1,332	18	Brazil 989.
Worked, natural kilograms	2,125	2,189	70	Mainland China 917; India 360; Japan 210.
Synthetic do	21,857	21,478	5,592	Switzerland 13,716; France 5,300.
Dolomite thousand tons	148	241	195	Belgium-Luxembourg 181; Austria 29.
Feldspar	52,977	48,745	21,951	Norway 18,087; Italy 13,329; France 8,507.
Fertilizer materials:				
Crude, natural:				
Phosphatic thousand tons	2,506	2,761	741	United States 1,219; U.S.S.R. 741; Morocco 282.
Nitrogenous (natural sodium nitrate).	6,018	3,764	------	All from Chile.
Organic including guano	17,720	17,166	14,261	Netherlands 10,174; France 4,028.
Manufactured:				
Nitrogenous	236,743	388,284	NA	NA.
Phosphatic:				
Basic slag	586,057	535,863	491,066	Belgium-Luxembourg 490,333.
Other	18,383	28,639	22,600	Netherlands 17,756.
Potassic	37,618	91,544	30,066	Canada 58,875; France 30,009.
Other	19,023	23,153	21,589	France 16,482; Belgium-Luxembourg 4,330.
Ammonia, anhydrous	------	27,105	25,583	Netherlands 23,834.

See footnotes at end of table.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources	
			EEC [1]	Principal sources
NONMETALS—Continued				
Fluorspar	120,342	118,442	70,084	France 64,693; Spain 30,594.
Graphite, natural crude or ground	14,513	16,974	118	Austria 5,638; Southern Rhodesia 3,009; mainland China 2,272.
Gypsum and anhydrite	100,805	121,295	45,691	Austria 75,178; France 45,093.
Iodine	415	465	------	Japan 357; Chile 105.
Lime, hydraulic or slaked	125,082	130,945	126,992	France 126,639.
Magnesite:				
Crude	1,142	1,508	406	Greece 783; Netherlands 406.
Causitic calcined, sintered or fired	313,996	802,259	11,600	Austria 159,014; Czechoslovakia 64,353.
Magnesite, dolomite, chromite refractories.	37,389	24,616	255	Austria 22,377.
Mica:				
Crude, including splittings and waste.	5,477	7,928	667	India 1,769; United Kingdom 1,012; Norway 860.
Worked, including agglomerated splittings.	13	15	12	France 6; Belgium-Luxembourg 5.
Pigments:				
Earth colors, natural	1,892	2,598	328	Austria 1,481; Sierra Leone 710.
Iron oxides and hydroxides	12,689	10,984	6,090	Netherlands 3,643; Belgium-Luxembourg 2,428; United Kingdom 2,391.
Pyrite (gross weight)---thousand tons	1,440	1,437	10	Spain 515; Norway 399; Cyprus 217; U.S.S.R. 158.
Salt:				
Culinary	5,759	5,760	4,968	France 4,853.
Other	94,483	119,822	119,767	Netherlands 118,282.
Sodium and potassium compounds, n.e.s.:				
Caustic soda	59,682	85,799	82,227	Netherlands 74,871.
Caustic potash, sodium and potassium peroxides.	9,339	5,800	5,535	Belgium-Luxembourg 5,385.
Stone, sand and gravel:				
Dimension stone:				
Crude and partly worked:				
Marble and other calcareous. thousand tons	140	143	84	Italy 65; Portugal 16.
Slate do	7	7	4	Norway 2.
Granite, sandstone and other, n.e.s. do	604	614	8	Sweden 271; Austria 120.
Worked:				
Building and monumental. thousand tons	158	175	152	Italy 146.
Paving blocks and flagstones. thousand tons	101	95	1	Portugal 64; Poland 16.
Slate thousand tons	13	13	10	Italy 8.
Dolomite, chiefly refractory grade. do	148	241	195	Belgium-Luxembourg 181; Austria 29.
Gravel and crushed rock do	8,822	9,271	6,031	France 5,310; Denmark 1,781.
Limestone (except dimension stone). do	1,452	1,415	48	Austria 1,088; Sweden 287.
Quartz and quartzite ground and/or roughly squared.	44,981	49,821	20,013	Belgium-Luxembourg 17,751; Sweden 9,548.
Sand, including metal-bearing. thousand tons	1,890	1,874	1,799	France 1,215; Belgium-Luxembourg 381; Netherlands 203.
Sulfur:				
Elemental:				
Other than colloidal	372	324	100	United States 224; France 100.
Colloidal	344	134	133	Italy 132.
Sulfur dioxide	227	31	NA	NA.
Sulfuric acid	107,996	114,566	93,219	Belgium-Luxembourg 47,582; France 23,325; Netherlands 22,312.
Talc, steatite, soapstone and pyrophyllite.	68,430	61,298	15,307	Austria 27,094; Norway 9,286; France 8,515.
Other nonmetals, n.e.s.:				
Crude: Meerschaum, amber, jet	17	21	------	U.S.S.R. 18.
Other:				
Slag, dross and waste nonmetal-bearing:				
From iron and steel manufactures. thousand tons	2,132	1,772	1,506	France 954; Belgium-Luxembourg 524.
Slag and waste, n.e.s. thousand tons	147	100	23	Denmark 70; Belgium-Luxembourg 15.
Oxides and hydroxides of magnesium, strontium and barium.	2,122	1,756	487	United States 735; United Kingdom 504.

See footnotes at end of table.

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Table 5.—Federal Republic of Germany: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	1967 sources	
			EEC [1]	Principal sources
NONMETALS—Continued				
Other nonmetals, n.e.s.—Continued				
Bromine and fluorine	209	320	203	Italy 126; Israel 115; France 77.
MINERAL FUELS				
Asphalt and bitumen, natural	21,248	18,779	35	Trinidad and Tobago 12,070; United States 6,616.
Carbon black	40,252	33,791	20,085	United States 11,026; Netherlands 9,215; Italy 6,383.
Coal, lignite, peat:				
Anthracite and bituminous. thousand tons	6,782	6,577	738	United States 4,896; United Kingdom 385.
Bituminous briquets do	291	275	275	Netherlands 268.
Lignite and lignite briquets do	1,083	1,146	3	Czechoslovakia 1,127.
Peat and peat briquets do	22	18	14	Netherlands 14; Denmark 3.
Coke, except petroleum coke do	507	566	458	Netherlands 340; Belgium-Luxembourg 110; Czechoslovakia 63.
Gas:				
Natural	83,276	721,868	717,652	Netherlands 689,729; France 24,154.
Manufactured	1,021	------	------	
Hydrogen and rare gases	172	446	NA	NA.
Petroleum:				
Crude, including shale oil. thousand tons	67,686	71,999	------	Libya 22,582; Saudi Arabia 11,700.
Refinery products:				
Gasoline do	2,534	3,262	2,439	Netherlands 1,118; France 574; Italy 510.
Kerosine do	326	415	368	Netherlands 159; Belgium-Luxembourg 114; France 91.
Distillate fuels do	10,300	11,362	7,426	Italy 3,044; Netherlands 2,763; France 1,283.
Residual fuel oils do	3,089	2,462	1,959	France 1,047; Netherlands 561.
Lubricants do	198	158	83	Netherlands 37; Italy 31; United States 31; United Kingdom 30.
Mineral jelly and wax do	54	58	12	United States 34; Netherlands 9; Indonesia 5.
Nonlubricating oils, n.e.s. do	79	686	528	Netherlands 476; Venezuela 127.
Pitch and pitch coke do	30	31	3	Czechoslovakia 23; Poland 4.
Petroleum coke do	375	333	------	United States 324.
Petroleum and shale oil residues. do	544	320	281	France 147; Netherlands 124.
Bitumen and asphalt mixtures. thousand tons	18	16	12	Netherlands 9.
Tar, mineral, and other crude chemicals from coal, petroleum and natural gas.	248,840	270,320	119,322	Netherlands 65,764; United Kingdom 60,339; Belgium-Luxembourg 35,721; Czechoslovakia 33,791.

NA Not available.
[1] Belgium, France, Italy, Luxembourg, and the Netherlands.
[2] Includes oxides of tungsten and vanadium.
[3] Includes ores of thorium.

COMMODITY REVIEW

METALS

Aluminum and Bauxite.—West Germany imported nearly 2 million tons of bauxite in 1968. Alumina imports were not significant.

As a result of increased demand on the domestic and foreign market, the output of primary aluminum increased 1.6 percent and that of secondary by 25 percent. Aluminum foundries are the principal users of secondary aluminum. The semifabricating plants operated at virtual capacity throughout the year and increased output by 25 percent to 475,000 tons. Increase in aluminum castings output was still higher, 26.2 percent. Semimanufactures production by types of products were as follows in tons; sheets, strips, disks, and slugs 283,335; rods and sections 118,447; pipes and tubes 19,685; wires 3,658; electrical conductors 40,629; drop and other forgings 9,194.

Aluminum consumption increased at an annual rate of 6.6 percent during 1960–68, a rate higher than that of the growth in the

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economy. A 7-percent rate of increase is expected in the next few years.

Consumption in 1968, excluding secondary and direct scrap import, totaled 540,000 tons and consumption including secondary 716,000 tons. West Germny was the third largest aluminum consumer in the free world. The primary aluminum price was increased as of July to 56.25 cents per kilogram (25.5 cents per pound).

West Germany imported 292,000 tons of aluminum ingot and 69,000 tons of aluminum semimanufactures. Corresponding export figures were 23,000 and 118,000 tons, respectively. In addition, West Germany imported 67,000 tons of aluminum scrap and exported 7,800 tons. The net import of 269,000 tons of aluminum ingot was 65 percent more than in 1967.

The imbalance between domestic production and consumption and the resulting relatively large net imports led to a number of projects which will increase the 1968 production capacity of 287,000 tons by 150 percent during the next 3 to 4 years. Two smelters were under construction during the year. The first, being built by Alusuisse and Metallgesellschaft (each 50 percent) at Essen Bergeborbeck at a cost of $62.5 million will have an annual capacity of 88,000 tons, and is scheduled to begin production in the spring of 1971. The second, being constructed by Gebrueder Giulini G.m.b.H. at Ludwigshafen is being designed to produce 22,000 tons per year by the end of 1970, and will be expanded to 40,000 tons capacity by 1972.

Vereinigte Aluminium-Werke A.G. (VDM) was doubling the capacity of its Rheinwerk smelter to 90,000 tons by 1970. This will raise the company's total capacity of its four smelters to 250,000 tons per year. Company plans also call for increasing the alumina capacity at its Luenen plant by 100,000 tons to 350,000 tons.

Plans for two new aluminum smelters, a rolling mill, and a fabricating plant were announced as follows:[4] Kaiser Aluminum & Chemical Corp. and Preussag A.G. will build a plant at Voerde/Dinslaken on the Rhine in two stages. The first, with a capacity of 64,000 tons per year, is scheduled to be in operation in 1971. The second stage having the same capacity will be completed by 1975. Kaiser and Preussag will share equally in the venture which is estimated to cost $130 million. Reynolds International, Inc., a wholly owned subsidiary of Reynolds Metals Co., announced plans for the construction of a rolling mill, fabricating plant, and smelter in the Hamburg harbor area. It is planned to have the $30 million rolling mill and fabricating plant in operation by the end of 1971. The smelter, with a capacity of 100,000 tons annually, is planned for completion in 1973 and will cost an estimated $90 million. When completed this integrated aluminum complex will be the largest in the Federal Republic.

In the rolling mill of Aluminium Norf G.m.b.H. at Norf-Stuettgen, the cold rolling mill with 70,000 tons annual capacity came into operation in August. The Norf plant is the largest aluminum rolling mill in Europe. The hot-rolling mill has 200,000 tons rolling capacity and rolls sheets up to 2.8 meters in width. The cold rolling mill can roll sheets up to 1.86 meters in width.

Copper.—Refined copper production and consumption increased by 13.8 and 12.1 percent, respectively. Nearly 40 percent of the consumption is met by secondary metal. Consumption reached 608,831 compared with total refined copper output of 436,000 tons. Trade in copper in 1968 was as follows, in thousand tons:

	Imports	Exports
Ore	206	--
Scrap	111	32
Metal	523	145
Semimanufactures	54	63.8

The increase in production of copper semimanufactures was in response to domestic demand, because exports of semimanufactures in 1968 were 8,300 tons less than in 1967.

The price of copper wire bar in December 1968, $1,406, was $250 per ton less that at the beginning of the year. The highest price during the year was $1,868 per ton in June and the lowest was $1,021 in July.

The Norddeutsche Affinerie in Hamburg reportedly was planning an important expansion of its capacity in the coming years.[5] The Metallgesellschaft subsidiary VDM, acquired the Westfaelische Kupfer und Messingwerke A.G. The latter will phase out of producing semimanufactures and

[4] Metals Week. V. 40, No. 9, Mar. 3, 1969, p. 6.
[5] Metal Bulletin (London). No. 5350, Nov. 18, 1968, p. 19.

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concentrate on production of finished products.

Iron Ore.—In 1968 there were only 10 mines in operation and the decline in production continued. The Doernten mine of Ilseder Huette closed in April. Domestic ore accounted for 7 percent of the 28,737,000 tons of contained iron in all raw materials consumed in the production of pig iron.

West Germany imported 39,639,000 tons of iron ore including the French minette ore shipped to the Saar. Principal suppliers other than France and imports from these sources were as follows, in thousand metric tons: Sweden 12,889; Liberia 6,985; Brazil 4,729; Canada 2,101; Venezuela 1,664; and Mauritania 1,304.

Iron and Steel.—Production of pig iron, crude steel, and steel semimanufactures was the highest on record but steel production capacity remained the same. West Germany was the world's fourth largest steel producer and the Thyssen Group, West Germany's largest steel producer, ranked sixth among world steel producing companies.

The average number of employees in the industry remained stable so that productivity increased. Plant investments recovered from the slump of the previous 4 years. Average sale price of steel was $2.50 per ton higher than in 1967 and, with the decline in production cost, profitability improved.

Raw Material Consumption.—For pig iron production 59,681,000 tons of raw materials was used of which 44,031,000 tons was iron ore, 3,108,000 tons limestone, and 851,000 tons manganese ore. About 64 percent of the iron ore was sintered prior to smelting. In addition steel plants used 1,010,000 tons of iron ore.

The iron and steel industry as a whole used 21.6 million tons of solid fuels (of which 20.2 million tons was coke and coke breeze), 3.24 million tons liquid fuels, and 10,922 million cubic meters of oxygen.

Production.—West Germany produced 7.8 percent of the world crude steel output and 41.7 percent of the output of the European Economic Community (EEC). Utilization of steel capacity increased from 77 percent to an estimated 85 percent. About 5 million tons more crude steel was produced than in the previous year. Four million tons of special steel was produced.

Table 6.—Federal Republic of Germany: Raw materials consumed in the production of pig iron

(Thousand metric tons unless otherwise specified)

Commodity	1966	1967	1968
Iron ore:			
Domestic	6,529	6,365	6,810
Imported	31,119	33,634	37,721
Total	37,648	39,999	44,031
Manganese ore	680	659	851
Pyrite cinder	3,692	4,240	3,907
Slags and plant scales	4,961	5,221	5,589
Blast furnace dust	1,719	1,465	1,492
Scrap	641	542	500
Total metallic raw materials:			
Gross weight [1]	49,340	52,125	56,369
Iron content:			
Iron ore:			
Domestic	2,052	2,027	2,011
Imported	17,092	18,805	21,517
Manganese ore	69	86	94
Pyrite cinder	1,806	2,070	1,919
Slags and plant scales	2,211	2,333	2,240
Blast furnace dust	651	542	542
Scrap	544	457	414
Total iron content [1]	24,426	26,320	28,737
Limestone	2,720	2,982	3,108
Per ton of product	107	109	108
Phosphate	303	192	204
Total gross weight of metallic raw materials, limestone, and phosphate	52,363	55,300	59,681
Coke	15,796	16,516	17,546

[1] Data may not add to totals shown because of independent rounding.

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Table 7.—Federal Republic of Germany: Scrap supply and consumption

(Thousand metric tons)

	1966	1967	1968
Source:			
Iron and steel plants	9,152	9,075	10,134
Foundries	2,328	2,135	2,479
Purchases:			
Domestic	6,272	6,254	6,945
Imported	638	1,078	1,566
Other, including variation in stock estimates	2,655	2,654	2,683
Total, new supply	21,045	21,196	23,807
Consumption:			
Iron and steel plants	14,825	15,290	17,043
Iron and steel foundries	4,515	4,054	4,620
Consigned for export	2,011	2,092	1,825
Stocks at yearend	1,989	1,750	2,071

Table 8.—Federal Republic of Germany: Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1966	1967	1968
PIG IRON			
Producing plants—number	33	30	25
Blast furnaces available—do	141	139	123
Blast furnaces in operation at yearend—do	86	91	88
Maximum production capacity	34,800	35,900	37,040
Production:			
Thomas	13,709	13,485	14,248
Open hearth	9,698	11,987	13,929
Foundry	304	249	278
Spiegeleisen and blast furnace ferromanganese	296	254	328
Other	1,406	1,391	1,522
Total	25,413	27,366	30,305
Blast furnace charge:			
Iron ore:			
Domestic	1,344	1,422	1,435
Iron content	502	528	517
Imported	10,801	12,262	14,724
Iron content	5,961	6,963	8,791
Sinter and briquets	29,103	30,602	32,354
Iron content	16,021	16,930	17,859
Manganese ore	595	580	707
Iron content	63	80	83
Other iron-bearing materials:			
Slag, scale, cinder, dust	3,234	3,217	3,356
Scrap	641	541	499
Limestone	1,396	1,344	1,280
Phosphate rock	286	190	202
Coke:			
Total	15,796	16,516	17,546
Kilograms per ton of pig iron produced	617	599	579
STEEL			
Converters:			
Basic Bessemer:			
Total—number	58	54	43
In operation at end of year—do	49	44	36
Oxygen:			
Total—do	22	26	31
In operation at end of year—do	18	21	26
Furnaces:			
Open hearth:			
Total—do	173	150	134
In operation at end of year—do	93	96	95
Electric:			
Total—do	190	189	185
In operation at end of year—do	165	166	172
Maximum production capacity (all furnaces)	47,580	48,400	48,570

See footnotes at end of table.

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Table 8.—Federal Republic of Germany: Salient statistics of the iron and steel industry—Continued

(Thousand metric tons unless otherwise specified)

	1966	1967	1968
STEEL—Continued			
Production of crude steel:			
Basic Bessemer	9,795	8,467	7,664
Oxygen	8,653	11,562	15,258
Open hearth	13,762	13,599	14,544
Electric	3,090	3,108	3,684
Other	15	8	10
Total [1]	35,315	36,744	41,159
Ingots	34,738	36,218	40,526
Liquid steel for castings	577	526	633
Furnace feed for ingot steel:			
Pig iron:			
Total	23,605	24,717	27,722
Kilograms per ton crude steel	(680)	(682)	(684)
Scrap:			
Total	14,170	14,739	16,536
Kilograms per ton crude steel	(408)	(407)	(408)
Preblown Thomas and other presmelted steels	95	62	17
Ferroalloys and alloying metals	274	284	354
Other iron bearing materials	776	847	972
Iron and manganese ores	797	846	1,010
Total iron-bearing materials [1]	39,717	41,495	46,612
Limestone	2,634	2,761	3,118
CASTINGS			
Iron and steel foundries in operation—number	964	909	881
Production of iron and steel castings	3,915	3,579	4,156
Consumption of raw materials:			
Pig iron	1,594	1,455	1,790
Scrap	4,515	4,054	4,620
Ferroalloys and other metals	75	68	77
Total [1]	6,184	5,577	6,485
EMPLOYMENT			
In coking plants of smelters—persons	2,427	2,237	1,892
Blast furnace, steel mills, hammer and forge shops—do	378,220	361,512	364,870
Foundries—do	157,301	144,821	149,167

[1] Data may not add to totals shown because of independent rounding.

The substantial decline in the number of Bessemer furnaces in operation was more than compensated, in terms of output, by the increase in the number of oxygen and electric furnaces in operation. For the first time, oxygen steel exceeded in tonnage that produced by other furnace types. The 15-percent rise in the output of steel semimanufactures was primarily due to the substantial increase in production of flat products.

Shipments.—Steel shipments in 1968 was as follows, in million tons:

	1967	1968
Semifinished	11.2	11.8
Rolled steel	22.4	25.1
Total	33.6	36.9

The semifinished steel consisted of 6.64 million tons of marketed intermediate products and 5.14 million tons of hot-rolled wide strip. Of rolled steel shipments, flat products totaled 11.5 million tons (excluding 775,100 tons of galvanized and 630,000 tons of tinplate), and bars and rods 7.35

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million tons; wire bars were the next most important group with 2.96 million tons.

Domestic demand for steel products in 1968 was estimated at 28.6 million tons, of which domestic producers supplied 21 million tons and foreign sources about 7.6 million tons. The higher demand reflected a 10-percent increase in consumption.

Table 9.—Federal Republic of Germany: Production and consumption of sinter

(Thousand metric tons unless otherwise specified)

	1966	1967	1968
Production:			
Gross weight	29,081	30,669	32,280
Iron content	16,039	16,998	17,839
Consumption of raw materials:			
Iron ore	25,588	26,394	28,016
Cinder	3,603	4,184	3,860
Slags and scale	1,816	2,060	2,285
Blast furnace dust	1,717	1,465	1,487
Limestone	1,324	1,638	1,828
Iron content of materials consumed:			
Iron ore	12,686	13,347	14,231
Cinder	1,781	2,058	1,909
Slag and scale	954	1,086	1,202
Blast furnace dust	651	542	540
Total	16,072	17,033	17,882

Table 10.—Federal Republic of Germany: Production of finished steel

(Thousand metric tons)

	1966	1967	1968
Wire rods	2,674	2,844	3,122
Bars and rods	5,256	5,039	5,563
Angles, shapes, sections (excluding rails)	2,171	2,057	2,155
Universal plates	378	370	465
Other heavy plates and sheets (more than 4.75 millimeters thick)	3,594	3,445	4,025
Medium plates and sheets (3 to 4.75 millimeters)	518	459	521
Thin plates and sheets (less than 3 millimeters)	4,374	4,670	6,199
Hot rolled strip including skelp	2,349	2,253	2,642
Hot rolled wide strip	999	1,652	2,013
Rails and railway track material	432	514	374
Seamless steel tubes	1,500	1,619	1,618
Total finished steel [1]	24,244	24,922	28,697
Selected semimanufactures:			
Tin plate	599	650	877
Galvanized and ternplate	623	700	951
Steel pipe welded	923	1,022	1,222
Extrusions and forgings	490	499	600
Steel castings	298	272	325

[1] Data may not add to totals shown because of independent rounding.

Trade.—Imports of scrap, pig iron, and ferroalloys and steel increased. Compared with 1967 levels, imports of steel were 50 percent higher while exports increased 7 percent. Export surplus for semifinished and finished steel fell to 4.8 million tons from 6.7 million tons in 1967. The market share of imported steel rose from 20 to 26 percent.

Industry Developments.—The Commission of the European Economic Communities approved the merger application of August-Thyssen Huette A.G. (ATH) which produced 11.5 million tons of steel in 1968 and Huettenwerke Oberhausen A.G. (HOAG) which produced 2 million tons in 1967. The merger took place giving the new combine more than 13 million tons of steel capacity per year. ATH will benefit from the merger through sizable savings in investments. HOAG has surplus pig iron capacity, and ATH can thus postpone plans to increase capacity. HOAG will concentrate on producing open-hearth steel based on scrap and ATH will replace its Bessemer converters with oxygen converters. The two 300-ton oxygen converters of ATH under construction in Duisburg-Bruckhauser with 3.6 million tons annual capacity were scheduled to go into operation in 1969. ATH's integrated plant at Duisburg-Hamborn is Europe's largest.

Merger talks were held between Hoesch A.G., Dortmund, and Rheinische Stahlwerke, Essen, but by yearend the two companies had not merged. They have a combined yearly capacity of 7 million tons of steel and both are members of the Waltzstahlkontor Westfallen, one of the four syndicates that handle sales of West German steel products.

Korf Industrie und Handel G.m.b. K.G., a complex of several medium-sized steel processing and trading firms, announced plans to build with a U.S. partner, Midland-Ross Corporation, electric steel furnaces (300,000 tons annual capacity) and a rolling mill in the Hamburg harbor area. The furnaces will use prereduced pellets produced by a process developed by Midland-Ross. Korf also plans to build a 300,000-ton-per-year electric furnace steel plant with a four-strand continuous casting plant in Kehl in southwest Germany (Badische Stahlwerke G.m.b.H.). The steel will be used by the company's existing rolling mill. This newcomer to steel production

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locates its small plants outside the traditional site of the German steel industry.

Mannesmann A.G., Duesseldorf, and Hoesch A.G., Dortmund, were planning to build, at a cost of $50 million, a semicontinuous hot-rolled wide-strip mill at Duisburg-Huckingen with an annual capacity of 2.5 million tons of 79-inch-wide strip. However by yearend no action had been taken to implement the plan.

On the labor front a 5-percent increase in wages and salaries of steelworkers and industry staff in North Rhine/Westphalia was agreed retroactive to June 1, 1968. The agreement can first be terminated November 30, 1969.

Lead-Zinc.[6]—Six lead-zinc mines were in operation in 1968. The decline in mine lead output resulted from declining production at the Maubach open-pit mine which is scheduled to be closed in March 1969 because of exhaustion of reserves. However, mine zinc output increased by 3,000 tons to a total of 110,000 tons, a record for the postwar period. Lead-zinc mines including the zinciferous pyrite mines, employed 3,484 workers. Lead-zinc ore produced averaged 5.84 percent lead and zinc content.

The output of lead and zinc metal showed the same pattern as ore, with a decrease of 16,000 tons in lead and an increase of 19,000 tons in zinc. Of ore smelted in lead furnaces, 44 percent was of West German origin, but 56 percent of the lead was obtained from material other than ore. For zinc 70 percent of the ore smelted was indigenous ore and 60 percent of the zinc output came from ore.

Lead and zinc prices averaged $239 and $269 per ton, respectively. Lead prices averaged 6 percent higher than in 1967, but zinc prices were slightly lower.

In the 1958–68 decade, lead consumption increased at an annual average rate of 5 percent; in 1969 a 4-percent increase rate is anticipated. Consumption in 1968 was estimated at 290,000 tons. Smelter capacity was sufficient for consumption requirements. Lead consumption by principal uses and their respective shares in percentages were as follows; battery 30.5; cable 28.0; semimanufactures 18.0; paints and chemicals 16.0; other 7.5. Consumption is expected to increase to 330,000 tons of refined lead by 1972.

Trade in lead was as follows, in thousand tons:

Commodity	Imports	Exports
Ore and concentrate	249.9	5.4
Scrap	9.0	10.2
Metals	90.9	44.1
Semimanufactures	1.5	6.8

Canada was the most important source of lead ore, although Ireland and Poland are becoming significant sources. Lead imports also included 35,000 tons impure lead obtained from the Imperial Smelting Process plants in the United Kingdom and Australia.

Zinc consumption in 1968 was estimated at 330,000 tons. In 1967, die casting used 50,000 tons and brass 68,000 tons of zinc. Zinc trade in 1968 was as follows in thousand tons:

Commodity	Imports	Exports
Ore and concentrate	236.1	116.8
Scrap	0.8	5.7
Metal	187.0	37.8
Semimanufactures	16.3	11.2

The share of European Free Trade Association (EFTA) countries in zinc imports has grown because of increased imports from Sweden and Finland.

Preussag formed a new company, Huettenwerk Harz,[7] which will be the principal zinc-producing entity in Preussag. It will control the Harlingerade and Oker smelters which will intensify their zinc activities, while continuing to produce some lead. The Nordenham smelter near Bremen will, on the contrary, concentrate on lead production. By 1970 these two smelters will produce 140,000 tons of zinc compared with current capacity of 120,000 tons. Nordenham will produce 70,000 tons of lead in 1970.

Stolberger Zink Aktiengesellschaft A.G. through its subsidiary, Gewerkschaft Maubacher Bleiberg, operated only the Maubach mine and the Binsfeldhammer lead smelter and has given up zinc smelting; the company is concentrating on zinc semimanutures. This company, with a subsidiary of Metallgesellschaft established two new firms —The Rheinische Zinkwalzwerk G.m.b.H. und Co. K. G., (Rheinzink) in Datteln and

[6] Fachvereinigung Metallerzbergbau e. V. Jahresbericht und Statistik (Yearly report and statistics, Trade Association, Metals Mining Ind. Org.). 1968, pp. 1–20.

[7] Metal Bulletin (London). No. 5349, Nov. 15, 1968, p. 20.

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Vereinigte Zinkwerke G.m.b.H. und Co., K.G. Rheinzink was building a continuous zinc rolling mill with an annual capacity of 60,000 tons of sheet and strip adjacent to the Datteln electrolytic zinc plant.

The Datteln electrolytic refinery was put in operation in August. The plant, designed to produce 80,000 tons of zinc from domestic and imported zinc concentrates, has a fluidized-bed roaster, gas cleaner, a 165,000-ton-per-year sulfuric acid plant, remelting furnaces, foundry, and alloying facilities.

The contribution of the Meggen zinciferous pyrite mine to total zinc output again increased. Performance of this mine was as follows, in tons:

	1967	1968
Mine-run ore	746,163	783,697
Marketable ore	647,831	682,087
Ore feed to flotation plant	567,849	606,054
Zinc-bearing concentrate produced	100,238	102,617
Lead-bearing concentrate produced	6,261	7,374

Nickel.—Consumption in 1968 is estimated at 35,000 tons compared with 33,000 tons in 1967. Stainless steel output also increased. Demand for nickel-chrome alloys, used in petroleum refineries, fertilizer plants, and synthetic fiber plants, has increased. Liquefied natural gas is stored in tanks made with 9-percent-nickel steel. Nickel-bearing alloys used in nuclear reactors have also contributed to the increase.

Precious Metals.[8]—West Germany's apparent consumption of gold, silver, and platinum in 1968 was 3,321,000, 58,193,000, adn 235,000 ounces, respectively. Apparent consumption of gold was less than in 1967, but apparent consumption was unusually high in 1967 because of high imports. Apparent consumption of silver increased 14 percent and of platinum by 10 percent.[9] Trade in these metals was approximately as follows, in thousand troy ounces:

	Imports	Exports
Gold	4,083	749
Silver	59,961	24,113
Platinum	326	9.6

Tin.—Statistical data for the tin industry were as follows, in long tons:[10]

Production:	
Primary	1,504
Secondary	935
Consumption:	
Primary	e 11,582
Secondary	953
Imports:	
Concentrates	969
Metal	11,883
Exports (metal)	1,090

e Estimate.

For the first three quarters of 1968 consumption by uses was as follows in percent: Tinplate 30.0; tinning 10.3; bronze and brass 2.0; solder 11.9; antifriction metal 2.8; other 43.0. During 1968, 3,645 long tons of tin was used for tinplating. Apparent tinplate consumption was 507,000 tons in 1967.

Important sources of metal imports, in long tons were Netherlands 3,593; Indonesia 2,969; Malaysia 2,578; Belgium 790; Nigeria 764.

Uranium.—The Federal Science Ministry estimated uranium oxide (U_3O_8) requirements during the period 1966–80 will range between 33,400 and 48,000 tons for nuclear facilities with installed capacities between 19,800 and 30,000 megawatts. The annual U_3O_8 requirements are estimated to increase from 408 to 595 tons in 1969 to between 5,850 and 10,100 tons in 1980.

The 1969 budget of the Federal Science Ministry includes $1,875,000 for "Assurance of Uranium Supplies." The Ministry besides participating in prospecting, mining, and beneficiating uranium ores in foreign countries, through qualified West German firms, will encourage long-term uranium supply contracts through agreements sharing the risks involved in long-term contracts. The Federal Government pays 80 to 85 percent of the exploration costs which are refunded if workable deposits are discovered. Uranium also would be stockpiled if the Ministry of Economic presents a bill for stockpiling of nonferrous metals and ores.

At the yearend there were three uranium ore companies in West Germany. Uran-Gesellschaft G.m.b.H., formed in 1967, was reportedly engaged in uranium exploration

[8] NE Metalle (Düsseldorf), No. 5, June 8, 1969, pp. 1–10.

[9] Apparent consumption of silver, reported previously as 59,120,000 ounces for 1967, is revised to about 51 million ounces.

[10] International Tin Council (The Hague, Netherlands). Statistical Bulletin. V. XIII, No. 5, May 1969, pp. 72.

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in many countries, including Canada and Australia. It obtained a prospecting concession in Somalia and was offered a 10-percent participation in the French-Nigerian company developing the Arlit deposit in Nigeria. Uran-Gesellschaft concluded its first contract with AEG-Telefunken to supply 336 tons of yellow cake for the first fuel charge at the Wuergassen nuclear powerplant.

Uranerzbergbaugesellschaft G.m.b.H. und Co. K.G., Bentheim, established in February 1968, also obtained a prospecting concession in Somalia and started prospecting in Ghana and Togo.

Gewerkschaft Brunhilde, which was part of Uranerzbergbaugesellschaft, was separated from the company in September to devote its efforts to domestic prospecting in Rhineland/Pfalz, Bavaria, particularly in the Maehring; and in Baden-Wuerttemberg.

Gewerkschaft Brunhilde's uranium beneficiation plant at Ellweiler processed ore from the Malagasy Republic and Maehring mine. Mobile pilot-scale leaching equipment was shipped to Maehring to leach the ore and produce a concentrate for shipment to Ellweiler.

NONMETALS

Cement.—Apparent consumption in 1968 was estimated to have increased by 6 percent to about 32 million tons or 538 kilograms per capita. Production capacity increased 1.3 million tons to 38 million tons per year. No new plants were built but the addition of four rotary kilns (800,000 tons per year total capacity) to existing plants and other improvements at existing installations accounted for the capacity increase. The industry employed about 19,400. West German trade in cement and clinker were as follows, in thousand metric tons:

	Imports	Exports
Clinker	80	111
Portland cement	149	813
Other cement	211	460

Fertilizers.—West German production of fertilizers in 1968 was as follows:

Type	Thousand short tons	Change (percent)
Nitrogenous (N content)	1,567	0.3
Phosphatic (P_2O_5 content)	905	—.7
Potassic (marketable) (K_2O content)	2,220	4.2

Although potash output increased, the industry operated below capacity, estimated at 2.4 to 2.6 million tons K_2O. Sales increased during the year and the industry was able to dispose of stocks accumulated during 1965–66. Domestic potash consumption totaled 1,306,475 tons.

West Germany imported about $70 million of crude and processed fertilizers; its exports of these commodities were valued at $165 million. Phosphate rock, including ground, accounted for 53 percent of all fertilizer imports by value. For exports, nitrogenous fertilizers, including nitrogenous mixed fertilizers, contributed 60 percent to the total value and potash, crude and processed, 34 percent. Bochum Ruhr-Stickstoff A.G., West Germany's largest nitrogen producer, reportedly supplies 9 percent of the world market for nitrogenous fertilizers.

Highlights of crude and chemically processed fertilizer trade for 1968 were as follows, in thousand tons:

Type	Imports	Exports
Nitrogenous	250	1,636
Phosphatic:		
Phosphate rock	2,588	23
Thomas slag	516	215
Superphosphates	275	42
Potassic:		
Crude	-----	50
Potassium chloride	79	1,642
Potassium sulfate and other	4	319
Mixed:		
Nitrogenous	146	850
Nonnitrogenous	-----	82
Packaged (all kinds)	1	1

Wintershall A.G., which produces about half of the country's potash salts was taken over by the Badische Anilin und Soda Fabrik. The latter plans to build an 1,100-ton-per-day ammonia unit at Ludwigshafen, using Netherlands natural gas as raw material.

Fluorspar.—The increase in crude steel output and in the share of steel produced by the oxygen process increased the demand for fluorspar. Consumption in 1968 was an estimated 236,000 tons, with the iron and steel industry accounting for three-fourths of the total. Of acid-grade fluorspar consumed, 40 percent is used to make synthetic cryolite. To meet demands, imports increased by about 30 percent to 153,486 tons. Principal suppliers were

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France, United Kingdom, Spain, and mainland China.

Sulfur.—Test borings for sulfur carried out by the American Cyanamid Co. and Société Nationale des Pétroles d' Aquitaine at Suelfeld were suspended because of apparently poor results.

Domestic production of contained sulfur totaled 385,000 tons of which 258,500 tons was recovered from pyrite, 21,052 tons from coal, 92,384 tons from natural gas, and 13,445 tons from other sources. Consumption of sulfur from all sources totaled 1,468,909 tons, almost 20 percent more than in 1967. In 1967 sulfuric acid production accounted for 80 percent of the sulfur consumption. With 3,463,000 tons of sulfuric acid in 1968, production showed a 12.3-percent increase.

Imports of sulfur and pyrite in 1968 totaled 1,891,569 tons and 260,994 tons, respectively. Norway, Spain, and Cyprus were principal sources for pyrite and France and United States for sulfur.

The Norddeutsche Erdgas-Aufbereitungs G.m.b.H. will increase the capacity of its gas-treating plant by 1.8 million cubic meters to 3 million cubic meters per day by the end of 1969. The plant will then yield 120,000 tons of sulfur per year.[11]

MINERAL FUELS

Energy consumption in 1968 increased nearly 8 percent to 293 million tons of standard coal equivalent (SCE) compared with 270 million tons in 1967. The shares of the different energy sources and the corresponding 1967 figures were as follows:

Energy source	Percent of total primary energy consumption	
	1967 r	1968
Bituminous coal and anthracite	35.7	33.5
Lignite and "pech" coal	10.1	9.8
Petroleum	48.0	50.2
Natural gas	2.1	3.2
Hydroelectricity	3.3	2.7
Nuclear energy	.2	.3
Wood, peat, other	.6	.3
Total	100.0	100.0

r Revised.

The Government took actions in the energy sector with regard to coal and to creation of a national oil procurement organization.

A group of West German economic research institutes reported upon the short- and medium-term for West German coal within the energy economy. The study forecast primary energy consumption of about 354 million tons SCE in 1973 (270 million in 1967) of which bituminous coal would account for 87 million tons (97 million tons in 1967). Coal exports would add about 10 million tons SCE to 1973 coal consumption or a total market just under 100 million tons. Of the domestic consumption, powerplants would account for 45 percent of the total.

Coal.—West German coal mines sold 120.4 million tons[12] of coal in 1968 compared with 114.6 million tons in 1967; sales in 1969 are expected to total 115 million tons. The 1968 output of 112 million tons was the same as in 1967. Production is expected to decline to 110 million tons in 1969 while average productivity will probably increase to 3.7 tons from 3.5 tons per underground man-shift in 1968. Coal stocks were 8.4 million tons at yearend; there were 80 collieries at the beginning of the year. Employment in the industry was 272,000 of which 150,600 were underground workers. The decline in employment (down 10.7 percent) is expected to continue, but at a reduced rate.

The industry's condition improved during the year because of the strong upsurge in the West German economy. Production held steady while internal demand and exports increased and stocks and imports declined. Pithead stocks fell by more than 8 million tons. Imports of British, Netherlands, and Polish coal increased substantially, while imports from the United States declined (down 43 percent). The principal suppliers of coal in 1968 were the United States, United Kingdom, Poland, the Netherlands, and Belgium.

[11] Sulfur (London). No. 76, May/June 1968, p. 7.

[12] Production plus reduction in pithead stocks.

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Table 11.—Federal Republic of Germany: Coal and lignite industry

(Production, productivity, and employment by district)

	1965	1966	1967	1968
BITUMINOUS AND ANTHRACITE				
Production:[1]				
Ruhr—million tons	110.9	102.9	90.4	91.0
Saar—do	14.2	13.7	12.4	11.3
Aachen—do	7.8	7.4	7.0	7.3
Lower Saxony—do	2.2	2.0	2.2	2.4
Total—do	135.1	126.0	112.0	112.0
Output per man-shift:				
Ruhr:				
Underground—kilograms	2,766	3,006	3,366	3,644
Total mining—do	2,166	2,347	2,623	2,872
Federal Republic average:				
Underground—do	2,705	2,926	3,264	3,526
Total mining—do	2,130	2,299	2,561	2,794
Employment:				
Ruhr:				
Underground—thousand persons	181.0	160.5	133.3	117.5
Mine surface—do	51.6	46.4	38.7	32.9
Cleaning—do	22.4	21.6	19.1	17.2
Total including other workers and salaried employees—thousand persons	316.1	287.0	243.5	216.1
Federal Republic total:				
Underground—do	224.5	200.6	169.9	150.6
Mine surface—do	62.4	56.6	47.6	40.6
Cleaning—do	25.7	24.8	22.4	20.6
Total including other workers and salaried employees—thousand persons	387.7	353.9	304.8	272.2
LIGNITE AND SUBBITUMINOUS				
Production:				
Rhineland—million tons	86.5	83.6	83.0	87.9
Helmstedt, Hesse, and Bavaria—do	15.4	14.5	13.8	13.6
Total—do	101.9	98.1	96.8	101.5
Employment:				
Rhineland:				
Open pit—thousand persons	10.1	9.8	8.3	7.4
All other—do	12.3	12.0	11.7	10.9
Total—do	22.4	21.8	20.0	18.3
Helmstedt, Hesse, and Bavaria—do	11.0	10.4	9.1	7.9
Total—do	33.4	32.2	29.1	26.2
PITCH COAL				
Production—million tons	1.7	1.2	.9	.8
Employment—thousand persons	5.6	3.8	2.6	2.8

[1] Excludes small mines and leases.

Total wages paid by the industry (excluding miners' premiums, separation allowances, and travel allowances) continued to decline. They amounted to $605 million versus $634 million in 1967 and $741 million in 1966.

Relative shares of different coal ranks produced were as follows, in percent: Medium- to high-volatile coal (Flammkohle and Fettkohle) 86.1; bituminous and semianthracite (Esskohle and Magerkohle) 6.1; semianthracite to anthracite (Mägerkohle and Anthracit) 7.8. In 1967 the production cost per net ton of coal mined underground was estimated at $15 per ton with manpower and materials accounting for about 54 and 34 percent, respectively, and depreciation, overhead, and other costs for the remainder. Price of Ruhr coal, medium- and high-volatile, ranged between $16 and $17 per ton. Higher rank coal, lump grade, was priced higher.

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Production per man-shift for the miners at the coal face in the Ruhr increased 8.8 percent to 6,516 kilograms. In July 1968, 87 percent of total output was from fully mechanized mines. For flat and low dip seams, the figure was 100 percent. Efforts are continuing to increase productivity of steep seams. Faces with more than 1,000 tons daily output increased to 115 out of a total of 600 faces. Twenty-one percent of the output was from faces with hydraulic support.

Coal's share of the West German power production market rose from 41.9 percent in 1966 to 42.1 percent in 1967 and was estimated at 43 percent for 1968. It is expected to reach 46 percent in 1971. The amount of subsidized coal used in powerplants totaled 5.4 million tons in 1967 compared with 1.3 million tons in the second half of 1966. The Ministry of Economics estimates that the amount of subsidized coal used in powerplants will rise to 9 million tons in 1970. The subsidy applies to German coal and coal from other EEC countries.

During the year approximately 124 million tons of coal was available, consisting of production, withdrawals from stocks, and imports. This was 3 million tons more than in 1967. After exports of about 20 million tons, 104 million tons was available for domestic consumption. Available information at the time of writing on end uses is as follows:

From domestic coal:	
Coke ovens of coal mines	42.8
Briquetting plants	3.6
Mines powerplants	11.7
Mine consumption (est.)	2.1
Subtotal	60.2
From domestic and imported coal:	
Sales to—	
Powerplants	18.0
Industry other than steel	10.6
Household	6.4
Gas	3.1
Transportation	2.0
Iron and steel	2.2
Other	1.8
Subtotal	44.1
Total	104.3

Sales to iron and steel plants probably were largely imported coking coal. However, judging by amount of coke produced, coal throughput at steel plant coke ovens must have been about 5.7 million tons rather than the 2.2 million shown above.

Colliery powerplants produced 25.3 billion kilowatt-hours of electricity of which 17.7 billion kilowatt-hours was sold to other consumers. Electricity output by the collieries was equal to 13.7 percent of all electricity generated in the country.

Trade in coal, coke, lignite, and briquets in 1968 was as follows, in thousand tons:

	Imports	Exports
Coal	5,588	20,249
Coal briquets	311	159
Coke	296	9,266
Lignite	1,156	86
Lignite briquets	23	966

Of coal and coke exports 88 and 75 percent, respectively, were shipped to the European Economic Community (EEC). The United States supplied 61 percent of coal imports.

Coke.—Following the 4.3-million-ton decline in coke output at coal mines in 1967, there was an increase of 1,220 tons in 1968. However, in spite of the record steel output, total of coke output by the coal mines, steel plants, and gas works was only 451,000 tons more than in the previous year.

Lignite (Braunkohle).—There was a substantial recovery in lignite production and the downward trend noted since 1965 was arrested. Helmstedt accounted for 87.9 percent of total output and for more than the entire 4.75-million-ton increase in output.

The output was used as follows, in thousand tons:

Briquets	21,339
For electricity production by mines' own powerplants	7,448
Other	705
Shipments to public utilities	66,444
Other sales	5,580
Total	101,516

In 1968, 50,198 million kilowatt-hours of electricity was produced from lignite.

Natural Gas.—Production increased 55.8 percent to 5,785.8 million cubic meters, largely the result of increased output at gasfields between Weser and Ems, which accounted for 56 percent of total output, and the commencing of output in the Ems Estuary. West German natural gas reserves on January 1, 1968, comprised 202 billion cubic meters measured, 72 billion indicated, and 350 billion cubic meters inferred. The

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discovery of natural gas in the Zechstein Formation in the Sagemoor was considered promising. The well is near the Hengstlage gasfield, Germany's largest, however, output at this field is from a higher geological horizon.

Preliminary information revealed that total gas sales (including manufactured) from all sources increased 20 percent in 1968 to 58.2 billion cubic meters. Sales to households and to the chemical industry increased 20 and 65 percent, respectively. Sales of domestic and imported natural gas, and associated gas, converted to a standard calorific equivalent of 4,000 kilocalories per cubic meter, was about 15 billion cubic meters.

The 371 kilometer trunk pipeline from Emmerich on the Netherlands frontier to Lampertheim (36 inches in diameter except for the 47-kilometer 32-inch line between Rüsselsheim and Lampertheim) was in operation. An extension was completed to Mannheim which started receiving gas in October. The line is built with a throughput capacity of 5 to 6 billion cubic meters per year.[13]

A contract for delivering natural gas to Gasversorgung Sueddeutschland G.m.b.H. (GVS) was finalized during the year. A plan reported previously for a joint company formed by the four major south German gas distributors, was abandoned. A new gas purchasing company, Sueddeutsche Ferngas Gesellschaft (SdFG), will be formed to cover Baden-Wuerttemberg and southern Bavaria. SdFG will be owned one-third by Shell and Esso, one-third by Ruhrgas, and one-third by GVS and south Bavaria's Bayergas. The State Government of Baden-Wuerttemberg and Shell-Esso are also shareholders in GVS. By 1977 to 78, 1.26 billion cubic meters per year will be delivered with a minimum of 807 million cubic meters.

Petroleum.—Petroleum output totaled 8.0 million tons in 1968, almost unchanged from 1967 levels. Total petroleum shipments rose by 12.3 percent to 110.8 million tons and are expected to rise to 145 million tons by 1975. Domestic sales of petroleum products increased 11 percent to 90.7 million tons and domestic consumption including bunkers totaled about 101 million tons.

To meet consumption requirements 84 million tons of crude oil were imported (a 16.6-percent increase relative to 1967 figures). Libya accounted for 43 percent of imports; Middle Eastern countries for 38.4 percent (Saudi Arabia 16 percent, Iran 7.7 percent, Muscat-Oman 7 percent, and other Middle East sources, 7.7 percent); and Venezuela 4 percent of imports. The relative shares of Libya and Middle Eastern countries in West German imports are expected to shift in 1969 with Libyan and Middle East sources supplying about 55 and 30 percent, respectively. Product imports amounted to 20.6 million tons, a 6-percent gain over 1967 levels. Stocks of crude oil and refined products, including the contents of pipelines, amounted to 14.6 million tons at yearend, 10.6 percent higher than in 1967.

Table 12.—Federal Republic of Germany: Petroleum and natural gas production by areas

Area	1966	1967	1968
PETROLEUM, THOUSAND TONS			
North German basin:			
North of Elbe (Schleswig-Holstein)	858	887	893
Between Elbe and Weser (Hannover)	2,400	2,388	2,407
Between Weser and Ems	1,952	1,942	1,945
Ems Estuary	-----	-----	(1)
West of Ems (Emsland)	2,084	2,064	2,112
Upper Rhine Valley	197	202	192
Alpine Foreland (Bavaria)	376	443	433
Total	7,868	7,927	7,982
NATURAL GAS, MILLION CUBIC METERS			
Between Elbe and Weser (Hannover)	62	60	63
Between Weser and Ems	1,655	2,499	3,250
Ems Estuary	-----	-----	1,118
West of Ems (Emsland)	736	697	715
Upper Rhine Valley	64	59	48
Alpine Foreland (Bavaria)	299	399	592
Total	2,815	3,714	5,786

[1] Less than ½ unit.

Total refinery output of 89.7 million tons was about equal to domestic consumption of 90.7 million tons. Of total refined products produced, middle distillates comprised 34 percent, motor gasoline 13.7 percent and heavy heating oil 27.8 percent.

Exploration.—The German North Sea Consortium conducted no drilling in 1968

[13] Petroleum Times (London). V. 72, No. 1859, November 1968, p. 1635–1638.

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but late in the year it announced it would resume drilling in 1969. British Petroleum (BP) announced in December that it would begin its first test well in Berlin hoping to find natural gas. The well will be located at the northern edge of Grunewald.

Drilling activity in 1968 totaled 31,127 meters less than in 1967.

Type of well	Length drilled (feet)	No. of holes	
		Dry	Producing
Exploratory	105,894	34	5
Stepout	40,493	10	8
Production	45,749	4	23
Auxiliary	7,509	----	----
Total	199,645	48	36

Exploratory drilling resulted in discovery of an oil field, Oelheim-Sued, between Elbe and Weser, and three gasfields (Sagermeer, Varnhorn, Wietingsmoor) and a gas deposit (Oythe) between Weser and Ems.[14]

In West German explorations overseas, Wintershall A.G. discovered oil in Libya in November 1968 at wells A1 and A2 in concession 97. Elsewhere in Libya, a consortium consisting of the German subsidiary of Mobil Oil and Gelsenberg-Benzin A.G. began production from its fourth field located at Rakb, south of the Amal field. The two fields together had an output of 40,000 tons per month.

Consumption and Trade.—Fuel oils accounted for 59 percent of total domestic sales which totaled 90,656,000 tons. Fuel oils comprised 21,353,900 tons of medium and 31,965,200 tons of light fuel oil. The consumption of light fuel oil showed the highest rate of increase (12.9 percent), followed by gasoline (11.1 percent) and heavy fuel oil (7 percent).

Crude and product imports were valued at $1.4 billion and $557 million, respectively. West Germany exported 9.87 million tons of products valued at $255 million,

[14] Erdoel und Kohle. V. 22, No. 2, February 1969, p. 118.

Table 13.—Federal Republic of Germany: Shipments of petroleum products

(Thousand metric tons)

Commodity	1966	1967	1968
Domestic sales:			
Gasoline, all kinds	14,374	15,343	17,054
Kerosine, including turbofuel	841	1,066	1,232
Diesel oil	7,874	7,710	8,488
Fuel oils	46,494	47,923	53,319
Liquefied petroleum gas	1,540	1,674	1,834
Lube oil and greases	845	795	891
Petroleum coke	455	390	340
Bitumen	3,872	3,936	4,315
Refinery gases	1,590	2,043	2,302
Other products	584	661	882
Total [1]	78,470	81,540	90,656
Consumption by refineries:			
Fuel oil	2,992	3,212	3,752
Refinery gas	1,594	1,790	2,173
Petroleum coke	208	221	224
Total [1]	4,795	5,223	6,149
Bunker deliveries:			
Gas and diesel oil	787	745	833
Fuel oil	3,089	2,578	2,857
Lubricants	35	34	37
Total [1]	3,911	3,357	3,727
Exports	5,531	6,352	7,841
Other shipments	1,062	1,068	1,272
Changes in refinery stock [2]	+742	+1,050	+1,085
Balancing factor [2 3]	−806	−2	+79
Total products available [1]	93,704	98,587	110,809

[1] Data may not add to totals shown because of independent rounding.
[2] Plus denotes add; minus denotes subtract.
[3] Apparently, changes in nonrefinery stocks.

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leaving a net import of $1,702 million. Product imports consisted of 1,631,000 tons of partly refined products (Rohbenzin, Naturbenzin), 1,965,000 tons of gasolines, and 15,377,000 tons of middle and heavy distillates among others.

In November the Ministry of Economics modified import licensing procedures to implement the Government decision to end "self-restraint" in marketing light fuel oil and diesel oil. The modification removed the control exercised by the Ministry of Economics to limit the market growth of middle distillates to 3-percent per year.

Refining.—Throughput of crude in West German refineries and products obtained were 94,803,533 and 89,659,644 tons, respectively. This was equivalent almost to domestic sales and 91 percent of total shipments. Fuel oil including distillates used as heating oil accounted for 56 percent of total products. The increase for these types of products was 12.7 percent compared with the 13.8-percent increase for all products. The nominal refinery capacity at yearend totaled 113 million tons per year, an increase of 4.1 million tons or 3.8 percent. The increase was achieved by expansion of the Mannheim refinery from 2.5 to 3.6 million tons, the Esso refinery at Ingolstadt from 3.95 to 4.8 million tons, the ENI (Ente Nazionale Idrocarburi) refinery at Ingolstadt from 2.4 to 3.2 million tons, and the Union Wesseling refinery from 4 to 4.8 million tons per year. Esso owned 19.8 percent of the refinery capacity. Ownership of other companies and their percentage shares of total nominal capacity were Shell 14.1; BP 12.1; Deutsche Erdoel A.G. 8.2; and Gelsenberg 6.2.

It was announced during the year that the Esso Hamburg refinery would undergo a $37.5 million expansion project to increase capacity from 3.6 to 5.5 million tons. Also announced was the expansion of the annual capacity of the Karlsruhe refinery, owned by Deutsche Erdoel A.G./Texaco, Scholven Chemie, and Conoco, from 6.2 million tons to 11 million tons by 1971. When completed this latter refinery will be the largest in West Germany. The Saarland refinery at Klarenthal and the Marathon refinery at Burghausen are others which will be expanded.

Transportation.—During 1968, 68.5 million tons of crude oil were imported through pipelines as compared with 57 million tons in the previous year. Amounts imported through West German pipelines were as follows, in thousand tons:[15]

Nord-West Pipeline	
Wilhelmshaven-Rhine	20,705
Rotterdam-Rhine Pipeline	16,415
Transalpine Pipeline	
Trieste-Ingolstadt	14,583
South European Pipeline	
Marseille-German border	10,524
Central European pipeline	6,072

Imports via the South European Pipeline were 7 million tons less than in 1967 because of the coming into operation of the Transalpine Pipeline (TAL). It is estimated that the TAL will carry 16 to 17 million tons in 1969. Its initial capacity with five pumping stations is 25 million tons of crude oil per year, although eventually it can be increased with 11 pumping stations to about 54 million tons annually.[16]

The Deutsche Tanker Finanz G.m.b.H. was formed in Hamburg with an initial capital of $75,000 supplied by West German banks. The new company will seek private capital participation and Government subsidies to carry out a program to construct ten 200,000-ton supertankers. Esso Deutschland announced plans for deepening the Elbe by 12 meters to accommodate 75,000-ton tankers.

Industry Development.—Wintershall A.G. was merged with Badische Anilin und Soda Fabrik (BASF) during the year. Wintershall's natural gas and petroleum interests are important to BASF's petrochemical operations. Erdoel Raffinerie G.m.b.H., in which Wintershall has a 60-percent holding, supplies a substantial share of the petrochemical raw materials required by BASF's Ludwigshafen works. There is also a communality of interests for fertilizers because Wintershall is a large producer of potash and BASF is a large manufacturer of fertilizers. In 1967 Wintershall accounted for about 14 percent of petroleum output, 26 percent of the natural gas, 7 percent of refinery output, and about 49 percent of potash output and sales in West Germany.

During the year there was considerable maneuvering to buy shares of (CBAG) held by Dresdner Bank and Deutsche Bank. The

[15] Esso Magazin, (Hamburg). January 1969, p. 16.
[16] Bulletin de l' Industrie Pétrolière. No. 1228, Dec. 8, 1968, p. 1.

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Compagnie Française des Pétroles was in the forefront, but the talks were suspended at the request of the Federal Government which did not wish that the ownership of the remaining national oil companies to be diluted. CBAG is West Germany's largest oil producer and has its own crude supply from Libya (about 4 million tons) and 9 million tons of refinery capacity.

The Federal Government worked on a plan to create an all-German Unified Oil Supply Co. (Deutsche Erdoelversorgung G.m.b.H.). Its members would include CBAG, Preussag A.G., Union Wesseling, Deilman Bergbau, Wintershall, Scholven-Chemie, Union Rheinische, Deutsche Schachtbau, and Saarbergwerke. These companies together account for around 35 percent of the sales of crude oil in West Germany and control 29 percent of the refining capacity. They also have 30 to 40 percent of the natural gas business. The new company would receive Government subsidies and exploration loans and would have a share capital of $12.5 million.

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The Mineral Industry of Ghana

By Edgar J. Gealy[1] and Agnes J. Doughman[2]

In 1968, Ghana's total value of mineral production, excluding the value of refinery products, increased to an estimated $120 million from the $66 million estimated for 1967. The country continued to be a significant world producer of gold, diamonds, manganese ore, and bauxite in spite of general declines in output during 1968. The major contribution to the almost doubled mineral output value for the year was credited to the sharp rise in aluminum production as the Volta Aluminum Co., Ltd. (VALCO) recorded its first full year of capacity operation. The significance of aluminum production to the Ghanian economy was demonstrated by the impact of exports of the metal on the country's trade balance. In spite of a decline in agricultural exports, primarily cocoa, which provided about half the total export value in 1967, preliminary data point to a surplus trade balance in 1968.

New developments in the gold, bauxite, and diamond industries in 1968 gave rise to anticipated improvements in these sectors in the near future. During the latter part of 1968, several international oil companies were involved in negotiations with Ghana for offshore oil concessions. These activities could provide an area of future foreign investment for Ghana.

During 1968, the Bank of Ghana relaxed some of the country's monetary controls and increased commercial bank credit to some of the more productive sectors of the economy. Unemployment and underemployment continued to be a major domestic problem during 1968 as did the servicing of foreign debts. Apparently Ghana's gross national product again increased modestly in 1968 following the 3-percent rise in 1967.

PRODUCTION

Recorded mine production in Ghana was limited to a relatively few commodities, almost all destined for the export market. Output of all these commodities declined in 1968. Bauxite output fell almost 20 percent from the 1967 level while manganese ore output dropped approximately 17 percent. Declines in gold and diamond production were modest, approximating 5 percent and 4 percent, respectively. Quantity data for salt production, all for the domestic market, were not available for 1968, but, on the basis of value, output was about 20 percent lower than in 1967.

Output of the petroleum refinery at Tema was down slightly from the 1967 level, but, more significantly there was a shift in the pattern of product balance in favor of the heavier products such as residual fuel oil. Probably most of the residual fuel oil was exported in 1968 as it has been for past years as Ghana has little internal demand for the product.

The only recorded mineral commodity which registered a production increase in 1968 was aluminum ingot which rose to 108,902 tons in 1968 from 39,702 tons in 1967. This increase represented the first year of capacity production of VALCO. The company reported reaching capacity rates in November of 1967 and the 1968 output was about 5 percent over the rated capacity of the plant, indicating no major operating problems at the new installation. Achievement of full operation was approximately a year ahead of schedule.

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[1] Assistant to the Chief, Division of International Activities.
[2] Statistical assistant.

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Table 1.—Ghana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite	250,386	319,267	322,947	350,961	284,705
Metal	---	---	---	39,702	108,902
Gold—troy ounces	864,917	755,191	684,395	762,609	727,122
Iron and steel: Steel semimanufactures	---	e 8,000	e 8,000	e 12,000	e 12,000
Manganese ore and concentrate	462,067	604,023	587,332	498,389	413,829
NONMETALS					
Cement	---	NA	NA	NA	230,440
Diamond:					
Gem—thousand carats	378	25	282	254	e 245
Industrial—do	2,290	2,248	2,537	2,283	e 2,202
Total—do	2,668	2,273	2,819	2,537	2,447
Salt	31,107	26,655	35,562	35,820	e 29,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum:					
Refinery products:					
Gasoline, aviation and motor—thousand 42-gallon barrels	1,312	1,205	e 1,048	1,219	1,185
Kerosine and jet fuel—do	390	380	e 422	692	456
Distillate fuel oil—do	2,000	1,957	e 1,467	1,397	1,456
Residual fuel oil—do	1,755	1,635	e 1,683	1,555	1,931
Other—do	17	14	e 14	286	39
Total—do	5,474	5,191	e 4,634	5,149	5,067

e Estimate. NA Not available.

TRADE

Minerals and metals trade in 1967 continued to show a favorable balance; however, trade in all commodities continued a deficit balance although smaller than in 1966 as shown below:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	42	188
1967	54	240
Imports:		
1966	36	247
1967	39	256

During 1967 values for the three leading mineral exports, comprising 78 percent of total mineral export value, were gold, $20.5 million; diamond, $12.4 million; and manganese ore, $9.0 million. Aluminum, unwrought, amounting to $8.5 million supplied 16 percent of total mineral exports. The principal recipients of these mineral commodities were the United Kingdom, $27.8 million including all gold shipments; Netherlands, $4.5 million; Belgium-Luxembourg, $4.2 million; Norway, $4.1 million; and United States, $2.9 million.

Principal mineral and metal commodity imports were as follows: Crude petroleum, $8.8 million, mainly from the U.S.S.R.; aluminum oxide and hydroxide, $7.0 million, almost entirely from the United States; petroleum products, $6.4 million, mainly from the United States, the United Kingdom, and Nigeria; iron and steel, $5.6 million, chiefly from the United Kingdom and West Germany; cement, $4.9 million, chiefly from Poland and the United Kingdom.

In 1967, the United Kingdom provided 29 percent of Ghana's imports and received 28 percent of the exports. The percentage total of trade with Communist countries dropped drastically during the year.

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Table 2.—Ghana: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite	311,011	300,439	United Kingdom 241,640; Netherlands 43,279.
Metal, including alloys: Unwrought	r 3	39,582	United Kingdom 12,726; Japan 7,862; Argentina 5,368; Netherlands 5,294.
Gold, metal, unworked or partly worked. thousand troy ounces	690	767	All to United Kingdom.
Iron and steel: Metal, scrap	1	3,103	United Kingdom 2,290.
Manganese ore and concentrate	598,967	452,457	Norway 236,184; United States 129,777; Canada 41,638.
Nonferrous metal scrap, n.e.s	944	1,056	West Germany 408; United Kingdom 246; Japan 235.
NONMETALS			
Diamond, all grades thousand carats	1,999	1,990	Netherlands 618; Belgium-Luxembourg 606; United Kingdom 509.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude and partly refined. thousand 42-gallon barrels	57	(1)	All to Italy.
Refinery products:			
Distillate fuel oil do	5	8	All to United Kingdom.
Residual fuel oil do	1,415	1,522	Italy 485; Senegal 351; Nigeria 311; United Arab Republic 122.

r Revised.
1 Less than ½ unit.

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Table 3.—Ghana: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Oxide and hydroxide	18,614	116,515
Metal, including alloys:		
Unwrought	210	394
Semimanufactures	r 7,181	2,053
Copper, metal, including alloys, all forms	477	412
Gold, metal, unworked or partly worked—troy ounces	----------	610
Iron and steel:		
Metal:		
Pig iron, ferroalloys and similar materials	1,379	682
Steel, primary forms	331	332
Semimanufactures:		
Bars, rods, angles, shapes, and sections	314,683	13,163
Universals, plates and sheets	9,188	11,101
Hoop and strip	141	188
Rails and accessories	819	4,945
Wire	916	2,138
Tubes, pipes and fittings	r 14,038	3,724
Castings and forgings, rough	r 1,182	627
Lead, metal, including alloys, all forms	1,355	386
Platinum-group metals and silver: Metal, including alloys—troy ounces	----------	161
Tin, metal, including alloys, all forms—long tons	r 184	144
Zinc, metal, including alloys, all forms	r 324	892
NONMETALS		
Abrasives, natural, n.e.s—value, thousand	[1] $517	[2] $85
Cement	536,083	433,821
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	1,090	505
Products	8,310	3,039
Fertilizer materials:		
Crude	286	338
Manufactured	r 5,280	322
Gypsum and plasters	r 2,653	5,647
Lime	3,135	3,395
Salt and brines	717	189
Sodium and potassium compounds, caustic soda	3,459	3,065
Stone, sand and gravel:		
Dimension stone	r 2,167	4,585
Dolomite and magnesite	1,338	388
Gravel and crushed rock	590	936
Limestone (except dimension)	----------	30
Sand, excluding metal-bearing	2,351	164
Sulfur:		
Sulfur and unroasted iron pyrites	189	320
Sulfuric acid	r 1,533	598
Talc, steatite, soapstone, and pyrophyllite	322	883
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	53,377	29,809
Gas, hydrocarbon—42-gallon barrels	35	448
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	4,319	5,709
Refinery products:		
Gasoline—do	70	16
Kerosine and jet fuel—do	66	201
Distillate fuel oil—do	r 9	43
Lubricants—do	r 82	131
Other—do	r 180	254
Total—do	r 407	645
Mineral tar and other coal-, petroleum- or gas-derived crude minerals	625	188

r Revised.
[1] 1 cedi = $1.17.
[2] 1 cedi = $0.98.

COMMODITY REVIEW

METALS

Bauxite.—New bauxite deposits at Ichiniso were being developed by the British Aluminum Co., Ltd., as deposits at nearby Kanaiyerebo were nearing exhaustion. A new plant under construction to replace facilities at Awaso was scheduled for completion early in 1969. It will include trans-

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porting, crushing, and washing facilities. Bauxite production capacity will be about 400,000 tons annually.[3]

It was reported that prospecting for bauxite also was underway in the Kibi and Ejuanema areas.

As of 1968, all of Ghana's bauxite production was exported, virtually all to the United Kingdom. Alumina for use in the aluminum smelter at Tema was imported from the United States. Preliminary surveys indicate that investment approaching $70 million would be necessary to provide domestic alumina facilities. VALCO has stated its intent to continue examining the feasibility of using domestic materials wherever possible.

However, in view of the $120 million invested in the Tema smelter, it is not likely that another major investment in an indigenous alumina plant to use domestic bauxite will be made in the near future.

Gold.—Late in 1968, Lonrho Ltd. of the United Kingdom bought out the Ashanti Goldfields Corp. Ltd. also of the United Kingdom. Lonrho Ltd. has widespread interests in Africa and some dissent arose in Ghana over the fact that the company had holdings in Rhodesia. The Ghana Government issued a statement that the transfer of ownership in no way infringed the Southern Rhodesia Sanctions Decree 1968 (National Liberation Council Decree 290). After negotiations with Lonrho officials, the Ghanaian Government granted Lonrho, Ltd., a 50-year lease to work the Ashanti goldfields in return for the surrender of the 90-year lease held by Ashanti Goldfields, Corp. Ltd. granted in 1897. Under terms of the new contract, Lonrho will operate the Obuasi mines in central Ghana. In payment for the new lease, Lonrho is to issue new shares totaling 20 percent of Ashanti's capital to the Ghanaian Government with an option to purchase a further 20 percent of the shares at a price of $2.40 per share. Milling capacity is to be increased from an average 52,000 tons (yielding 40,300 ounces gold) to at least 80,000 tons per month within 2 years and to over 120,000 tons per month by 1974. With the change in ownership, the Government anticipates that the country will have a more significant role in the mining operation.[4]

Alluvial gold deposits have been located in the Ofin River in central Ghana. A Soviet geological team and members of the Ghana Geological Survey Department have estimated the deposits to be of sufficient economic value to be commercially developed.

The Government granted $1 million to the State Gold Mining Corp. to develop ore remaining in the abandoned Donkoto gold mine at Bibiani.

Iron Ore.—It was reported that two major iron deposits of commercial importance had been discovered. One is north of Takoradi in the Opan-Mansi Forest Reserve, the other at Shiene near the Togo border.

Mercury.—Despite reports to the contrary the Director of the Ghana Geological Survey states that no deposits of mercury had been found in the Sampa area. Studies on sulfide mineralization in the area continued at yearend.

NONMETALS

Cement.—Ghana's second cement plant, located at Takaradi Harbor, was opened in December 1968. The $3.3 million operation, built by the Polish firm of Cekop, has an annual capacity of 500,000 tons. It will be operated by the Ghana Cement Works Ltd. The plant will use imported clinker until local sources of raw materials for a completely integrated plant become available.

An embargo was to be placed on cement as the two plants (the older plant at Tema was built in 1964 with a 200,000-ton annual capacity) could satisfy national requirements.

Clay.—Production of china clay for export from an unidentified location was reportedly to start early in 1968.

Diamond.—The Consolidated African Selection Trust, Ltd. (CAST), by far the largest and most efficient diamond producer in Ghana, continued to produce 90 percent or more of the annual output. Five washing plants, Nos. 8 to 12, were working at near capacity. The new, more efficient No. 12 plant was being used to re-treat old tailings from the No. 7 plant, shut down early in 1968. As of March, the number of CAST

[3] Industrial Minerals. V. 16, January 1969, p. 35.
[4] Mining Journal (London). V. 272, No. 6988, Jan. 31, 1969, p. 97.

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employees totaled 2,728 including 84 African supervisors and 66 expatriates. Average annual production per worker was 915 carats. Over 300 of the African employees make up the security force.[5]

The Commission for Lands and Mineral Resources, on December 30, announced a new Board of Directors for the State Diamond Marketing Corporation, and Government approval of five marketing methods to be used by the Corporation. For the first time CAST is to be represented on the Marketing Corporation's Board of Directors.

The five methods of marketing diamond are as follows:

1. Sales by tender. Every 4 months a single consignment of diamond will be offered on a bid basis to licensed buying agents in Accra. Not more than two buyers from outside Ghana may be admitted. A reserve price on the tender and the total number of carats to be disposed of annually is to be agreed upon by the Board of Directors.

2. Sales by allocation. Every 4 months each of the registered buyers would be offered a consignment at a set price on a "take-it-or-leave-it" basis.

3. Sales through the Marketing Corporation's Antwerp office. A reasonable quantity to be sold annually through this outlet to enable the corporation to conduct market research and ascertain world demand.

4. Sales to local industries. The Ministry of Industries is studying several applications for the establishment of processing industries in Ghana. If and when applications are approved, an adequate supply of diamond will be guaranteed.

5. Special sales. Presumably the Marketing Corporation will sell to nonregistered buyers who express an interest and offer a good price.

These marketing methods are to be used for 6 months, during which time the Board will compare relative advantages and investigate other methods to increase foreign exchange earnings.[6]

A large-scale diamond dredging operation was being considered for the Birim River.

Diamond production data in Ghana represented sales to the State Diamond Marketing Corporation. Neither smuggled amounts nor what CAST or other producers hold back for later release have been included in the data. As of 1968 the "African Industry" was theoretically composed of about 260 licensed diggers who hired workers on a commission basis. The licensee was supposed to sell his winnings to the Marketing Corporation. In 1967, licensees sold only 18,800 carats to the Corporation as compared with 1.2 million carats in 1961. Smuggling was stimulated by the strict exchange controls imposed in 1960 and further by the creation of the Marketing Corporation in 1963. Estimates of the annual foreign exchange loss to Ghana caused by diamond smuggling ran as high as $14 million. The new marketing system and the softening of Nigerian currency because of the civil war in that country may reduce the amount of smuggling and bring forth (as production) some of the diamonds held off the market by licensees.

Lime.—A plant was to be established at New Duffour to produce quicklime from oystershell deposits in the Volta Basin area. The buildings were completed and production is to start when the necessary machinery is received and installed.

Limestone.—A survey of limestone deposits at Nauli, made by the Geological Survey Department, indicated that the deposits contain at least 400 million tons of stone suitable for the production of cement.

Mica.—Production of mica for export was due to start early in the year. Location of the operation was not available.

MINERAL FUELS

Natural Gas.—Rumanian technicians reportedly have found natural gas in noncommercial quantities in the Keta Basin.

Petroleum.—After obtaining its crude petroleum suppplies for a year from the six companies that market in Ghana (September 1967 through August 1968), the Government contracted with the Soviet Union for 700,000 tons (approximately 5 million barrels) of crude oil to be delivered in the year beginning September 1, 1968. This amount is about 900,000 barrels short of capacity refinery needs for a year. The marketing companies had taken over the supply function from the U.S.S.R. the year

[5] U.S. Embassy, Accra, Ghana. State Department Airgram A-51, Feb. 27, 1969, pp. 3-4.
[6] U.S. Embassy, Accra, Ghana. State Department Airgram A-5, Jan. 4, 1969, pp. 2-3.

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before by offering the prices that were in effect before June 1967, and agreeing to dispose of the surplus residual fuel oil produced at the refinery in excess of domestic demand.

Apparently Ghana has chosen to take Soviet crude oil to work off a $15 million trade surplus with the country. In the spring of 1968, Ghana had signed a barter agreement with the U.S.S.R. that included crude oil as a possible trade item. Although the price of the Soviet supplied crude has not been announced, it probably is quite low and the attractive price coupled with the trade surplus outweighed the offers made by the marketing companies for the same period. No information was available as to the source of supply for the remaining potential refinery demand or on the method of disposing of the anticipated excess residual fuel oil obtained from refining Soviet crude.

Several oil companies were negotiating with the Ministry of Land and Natural Resources over prospecting license agreements for offshore blocks in the Gulf of Guinea. By the December 31 deadline, six companies had signed for blocks for which they had negotiated. Texaco Ghana Petroleum Co., Ltd., took the largest amount, signing for Blocks 7 to 9, 11 and 12, totaling about 2,000 square miles. Jack Grynberg and Associates, with Standard Oil Co. of California, have Blocks 6, 13, and 16 for a total of 1,174 square miles. Mobil Exploration Ghana Inc. took Blocks 4 and 5 covering about 1,070 square miles. Other license holders are Frontier Ghana Oil Ltd., in association with Union Carbide Petroleum Co., who have Blocks 19, 20, 25, and 26; the combine of Signal Exploration and Development, Occidental of Ghana, and Amoco Ghana Exploration Co., each holding a one-third share in Blocks 10, 14, 15, and 15A with Signal to act as operator (Blocks 10, 14, and 15 were originally obtained by Simons Royalty Corp. and later turned over to the combine); and The Israel National Oil Co. Ltd., Blocks 21 to 24, where Rumanian surveyors had previously found noncommercial shows of natural gas. Offshore Blocks 1 to 3, 17, and 18, and onshore Blocks 27 to 35 remain unallocated. The disposition of these blocks is not yet clear.[7 8]

The agreements were reported to be valid for 30 years and renewable for another 10 years. The companies will pay $7,000 a block plus $25 annual rent a square mile in the first year, rising to $50 a square mile in the third year. Drilling is to start within 18 months and at least one well is to be completed to 12,000 feet within 2 years. A $150,000 bonus is to be paid 6 months after contract date for each 500 square miles of concession. Another $500,000 is to be paid within 30 days of commercial oil discovery; $1 million when exports average 100,000 barrels daily; and $2 million when exports reach an average 200,000 barrels daily. Rent will rise from $150 a square mile in the first year of development to $500 in the fourth and subsequent years. Royalties will be 12.5 percent of the posted price of crude and will be treated as an expense item, tax being payable at 50 percent. Each licensee is to give $50,000 per year toward the establishment and maintenance of a petroleum or petrochemical department at a Ghanaian university.[9]

It was reported that Rumanian technicians drilling for oil failed to locate any exploitable oilfields and closed operations in mid-1968.

[7] Oil and Gas Journal. V. 67, No. 2, Jan. 13, 1969, p. 66.
[8] Standard Bank Review, February 1969, p. 29.
[9] Oil and Gas International. V. 9, No. 2, February 1969, p. 81.

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The Mineral Industry of Greece

By Bernadette Michalski[1]

Petroleum refining and the metals industry were major contributors to the 6.5-percent increase recorded in Greece's industrial production in 1968; the industrial production increase in 1967 was only 3.3 percent. Output gains in petroleum and aluminum were chiefly the result of investments prior to 1967.

The nation's gross national product rose 5.6 percent in current prices to a level of $6.5 billion. Among the factors contributing to Greece's economic revival were liberalization of credit controls, development of a favorable climate for foreign investors, and availability of public funds for surveys and development. Foreign investors including Péchiney, Allgemeine Elektricitaets Gesellschaft, and Texaco Overseas Petroleum Co., were actively engaged in exploration, technical assistance and direct financing. The Greek Government made available $4.5 million in public funds for mineral surveys during the year.

PRODUCTION

Production of minerals and particularly metals made appreciable gains in 1968. Ferronickel and lead metal production increased by more than 50 percent each, steel ingot production increased by 36 percent and primary aluminum increased by 5 percent over that of the previous year. Nonmetal production remained relatively stable with only significant increases recorded in phosphatic fertilizer and cement production. Petroleum refinery production based entirely on imported crude increased by 20 percent. Lignite output, at present Greece's sole indigenous mineral fuel source, increased by 12 percent.

Investment in exploration, development, and expansion in various branches of the mineral industry envisages increased mineral output in the next 5-year period. Areas of particular growth are bauxite, alumina, aluminum, petroleum products, lignite, fertilizers, and cement industries.

[1] Foreign mineral specialist, Division of International Activities.

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Table 1.—Greece: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, gross weight--thousand tons	1,047	1,270	1,371	1,659	1,750
Alumina, gross weight	---	---	73,000	• 175,000	• 200,000
Metal, primary	---	---	36,000	72,000	76,000
Chromite	50,900	50,600	55,800	12,000	NA
Iron and steel:					
Iron ore and concentrate	---	6,000	26,000	17,000	12,000
Pig iron--thousand tons	164	463	NA	NA	NA
Steel ingots and castings--do	210	210	210	160	218
Steel semimanufactures--do	248	271	315	380	400
Lead:					
Concentrate, metal content	8,130	9,640	• 9,750	• 9,750	• 9,750
Metal, primary	4,128	r 5,317	r 5,400	6,587	8,861
Manganese ores and concentrate, gross weight •	90,000	80,000	90,000	80,000	80,000
Nickel:					
Mine output, metal content	---	645	1,490	2,158	3,735
Ferronickel, (24–28 percent nickel)	---	---	1,200	9,149	14,104
Metal	---	---	---	NA	264
Silver, metal--thousand troy ounces	154	139	138	238	267
Zinc concentrate, metal content	10,350	10,580	7,800	10,400	10,611
NONMETALS					
Abrasives, emery	7,600	7,600	7,600	7,600	7,600
Barite, refined--thousand tons	60	58	50	64	65
Cement, hydraulic--do	2,672	3,212	3,588	3,450	4,000
Clays:					
Bentonite--do	99	50	90	120	130
Kaolin--do	50	r 68	r 62	70	70
Fertilizers, manufactured:					
Nitrogenous--do	128	NA	228	700	220
Phosphatic--do	168	NA	549		790
Gypsum and anhydrite--do	141	100	120	210	215
Magnesite:					
Crude--do	360	315	375	425	400
Dead burned--do	47	64	70	100	100
Caustic calcined--do	55	49	40	35	28
Perlite--do	40	30	100	120	129
Pumice--do	229	200	300	350	283
Pyrite:					
Gross weight--do	115	104	135	180	210
Sulfur content--do	54	49	63	84	98
Salt, all types--do	101	87	91	95	99
Stone, dimension: Marble--do	131	128	147	150	152
Talc	3,764	3,500	3,500	5,000	4,500
MINERAL FUELS AND RELATED MATERIALS					
Coal: Lignite--thousand tons	3,859	5,080	4,840	5,000	5,600
Fuel briquets: Lignite briquets--do	160	175	135	100	100
Gas, manufactured--million cubic feet	425	425	388	NA	385
Petroleum, refinery products:					
Gasoline:					
Aviation--thousand tons	31	32	167	266	325
Motor--do	252	240	320	401	465
Kerosine--do	145	133	154	104	89
Distillate fuel oils:					
Gas oil--do	17	18	761	1,096	1,313
Diesel oil--do	585	595			
Residual fuel oil--do	710	687	1,365	1,706	1,753
Liquefied petroleum gas--do	33	42	46	54	61
Asphalt and bitumen--do	64	81	55	65	76
Refinery gases--do	15	16	NA	NA	NA
Other--do	13	14	41	10	12

• Estimate. p Preliminary. r Revised. NA Not available.

TRADE

Greece's 1967 mineral exports increased in value by about 50 percent over those of 1966. About 70 percent of this increase was attributed to expanded exports of nonferrous metals, particularly aluminum. Minerals accounted for 16 percent of Greece's total commodity exports. The European Economic Community (EEC) continued as the principal market receiving more than half of the mineral export. Mineral com-

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modity imports accounted for 18 percent of total commodity imports by value. The value of mineral imports again declined about 2 percent in 1967. Small reductions in imports of metals and fertilizers contributed to the reduced import value. About 40 percent or $87.7 million of mineral imports represented crude oil and petroleum products and $64.4 million or 30 percent was attributed to iron and steel. The EEC continued as principal supplier in 1967 with imports from that area valued at nearly $80 million. The relationship of mineral trade to total commodity trade in recent years was as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	32.2	327.8
1966	52.2	406.0
1967	78.6	495.2
Imports:		
1965	223.9	1,133.7
1966	220.7	1,222.9
1967	216.8	1,186.3

Table 2.—Greece: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite and concentrate thousand tons	1,169	1,132
Metals, including alloys:		
Unwrought	27,580	59,917
Semimanufactures	1,369	2,200
Chromite	20,671	13,439
Copper:		
Matte	220	159
Metal, including alloys:		
Scrap	49	-------
Semimanufactures	1,166	1,338
Iron and steel:		
Ore and concentrate, except roasted pyrite	-------	-------
Roasted pyrite	32,538	58,408
Steel, primary forms	20,154	7,174
Semimanufactures:		
Bars, rods, angles, shapes, sections	5,454	NA
Universals, plates and sections	177	1,901
Tubes, pipes and fittings	447	779
Lead, ore and concentrate	10,250	11,113
Manganese ore and concentrate	24,042	6,517
Nickel metal, including alloys, all forms	483	7,040
Zinc:		
Ore and concentrate	20,738	24,331
Metal including alloys, all forms (scrap)	98	-------
Other: Ash and residues containing nonferrous metals	1,724	1,540
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	192,743	120,707
Grinding and polishing wheels and stones	127	88
Barite and witherite	48,316	62,847
Cement	205,107	353,920
Clay and clay products:		
Crude clays, n.e.s	99,599	118,527
Products:		
Refractory (including nonclay bricks)	1,648	1,675
Nonrefractory	1,378	1,670
Fertilizer materials, manufactured:		
Phosphatic	10,397	40,225
Other	-------	20,000
Magnesite	145,294	148,224
Pyrite (gross weight)	6,030	4,328
Stone, sand and gravel:		
Dimension stone, crude and partly worked	25,831	24,586
Other	r 225	1,061
Sulfur:		
Elemental	20,686	7,797
Sulfuric acid	201	-------
Other nonmetals:		
Crude	70,886	86,345
Slag, dross, and similar waste, not metal bearing	2,726	-------
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline (including natural)	9,019	27,958
Kerosine and jet fuel	88,772	88,350
Distillate fuel oil	20,500	50,663
Residual fuel oil	26,845	72,563
Lubricants	966	759
Mineral tar and other coal, petroleum, or gas derived crude chemicals	7,083	-------

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Table 3.—Greece: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	39,949	201	All from Australia.
Oxide and hydroxide	11,247	1,744	France 1,586.
Metal, including alloys:			
Unwrought	6,509	2,459	Canada 1,460; Austria 384; United Kingdom 252.
Semimanufactures	1,519	1,122	West Germany 409; France 251; Italy 225.
Arsenic trioxide, pentoxide, and acids	67	151	France 100.
Chromium oxide and hydroxide	184	153	West Germany 124.
Copper:			
Ore and concentrate	-------	1,596	Algeria 937; Morocco 659.
Metal, including alloys:			
Unwrought:			
Blister and other unrefined, unalloyed.	601	8,618	Zambia 4,039; Congo (Kinshasa) 2,036; Congo (Brazzaville) 938; Belgium-Luxembourg 905.
Refined, unalloyed	4,912	8,618	Zambia 4,039; Congo (Kinshasa) 2,036.
Semimanufactures	652	487	West Germany 189; Italy 70.
Iron and steel:			
Ore and concentrate	405,216	178,058	Liberia 85,589; Tunisia 69,947; Algeria 20,003.
Metal:			
Pig iron, including cast iron	27,894	27,748	U.S.S.R. 11,076; West Germany 4,627; East Germany 4,500; Bulgaria 3,702.
Sponge iron, powder and shot	840	555	United Kingdom 287; West Germany 97; Italy 84.
Spiegeleisen	215	582	Republic of South Africa 579.
Ferroalloys:			
Ferromanganese	642	783	Republic of South Africa 641.
Other	1,808	1,113	Republic of South Africa 554; France 284; West Germany 123.
Steel, primary forms—thousand tons	81	49	France 23; United Kingdom 13; West Germany 7.
Semimanufactures:			
Bars, rods, angles, shapes, sections. do	167	161	West Germany 43; France 38.
Universals, plates and sheets do	149	159	West Germany 36; Belgium-Luxembourg 34; United Kingdom 30.
Hoop and strip do	75	77	Belgium-Luxembourg 38; West Germany 20; Italy 12.
Rails and accessories do	3	8	West Germany 5; France 2; Austria 1.
Wire do	NA	6	West Germany 2; Belgium-Luxembourg 1; Norway 1; Austria 1.
Tubes, pipes, and fittings do	17	15	West Germany 5; France 2; United Kingdom 2; Italy 2.
Castings and forgings, rough do	1	2	Italy and France less than one half unit.
Lead:			
Ore and concentrate	7,064	8,289	Morocco 6,008; Algeria 2,281.
Oxides	967	950	France 784; West Germany 145.
Metal, including alloys:			
Unwrought	2,688	2,340	United Kingdom 792; Mexico 563; Republic of South Africa 538.
Semimanufactures	106	132	Netherlands 115.
Mercury—76-pound flasks	1,073	848	Italy 819; West Germany 29.
Molybdenum metal, including alloys, all forms. kilograms	1,000	-------	
Nickel metal, including alloys, all forms	61	74	West Germany 29.
Platinum-group metals and silver, including alloys:			
Platinum group—value, thousands	$13	$1	NA.
Silver do	$446	$300	West Germany $232.
Tin metal, including alloys, all forms. long tons	260	215	Malaysia 114; Netherlands 60; United Kingdom 29.
Titanium oxides	2,116	2,418	West Germany 1,039; United Kingdom 701.
Tungsten metal, including alloys, all forms. value, thousands	$98	$80	West Germany $47; Netherlands $28.]
Zinc:			
Oxide	846	441	France 206; West Germany 78; Netherlands 78.

See footnotes at end of table.

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Table 3.—Greece: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Zinc—Continued			
Metal, including alloys:			
Unwrought	7,942	7,493	Belgium-Luxembourg 2,817; Zambia 1,376.
Semimanufactures	224	237	Poland 112; West Germany 58; United States 54.
Other:			
Ore and concentrate	r 295	250	Australia 208; United Kingdom 47.
Ash and residue containing nonferrous metal.	127	55	NA.
Metals, including alloys, all forms:			
Metalloids	73	26	West Germany 5.
Alkali, alkaline earth, and rare-earth metals.	4	3	NA.
Pyrophoric alloys	2	3	NA.
Base metals, including alloys, all forms	59	117	France 49; Japan 29.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	32	153	Mainly from West Europe.
Grinding stones	256	288	West Germany 40.
Asbestos	3,911	5,514	Republic of South Africa 2,330; Canada 1,466; U.S.S.R. 1,156.
Cement	1,359	1,100	Denmark 664; France 389.
Clays and clay products (including all refractory brick):			
Crude clays, refractory	17,933	22,427	United Kingdom 16,007; West Germany 2,535.
Products:			
Refractory (including nonclay bricks)	28,721	15,007	West Germany 4,771; France 2,405; Austria 2,062; United Kingdom 1,599.
Nonrefractory	8,190	8,078	Italy 6,238.
Diatomite and other infusorial earths	1,430	1,389	Yugoslavia 1,047.
Feldspar and fluorspar	365	1,491	Italy 485; Canada 318; West Germany 279.
Fertilizer materials:			
Crude:			
Nitrogenous	7,978	969	Chile 525; West Germany 390.
Phosphatic—thousand tons	227	332	Tunisia 176; Morocco 105; Senegal 50.
Manufactured:			
Nitrogenous—do	156	140	France 39; Italy 34; West Germany 29; United States 23.
Phosphatic—do	21	18	Tunisia 12; Italy 6.
Potassic—do	28	18	France 15.
Other, including mixed—do	52	48	Italy 28; France 10; Belgium-Luxembourg 5.
Ammonia—do	10	15	Italy 7; Denmark 3.
Graphite, natural	294	260	West Germany 107.
Gypsum and plasters	412	758	West Germany 441.
Magnesite	340	394	Austria 338.
Mica:			
Crude, including splittings and waste	30	22	India 2.
Worked, including agglomerated splittings	9	9	Belgium-Luxembourg 6; India 1.
Pigments:			
Natural, crude	141	184	Mainly from West Europe.
Iron oxides processed	950	985	West Germany 932.
Precious and semiprecious stone, except diamond, synthetic.	value, thousands $34	$32	France $14; Switzerland $12.
Pyrite (gross weight)	2,804	-------	
Sodium and potassium compounds:			
Caustic soda	39,359	29,086	Italy 21,518; France 3,632.
Caustic potash	159	226	France 91; West Germany 53; East Germany 51.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	426	798	West Germany 461.
Worked	695	1,303	Italy 67.
Dolomite, chiefly refractory grade	144	770	Italy 455; Belgium-Luxembourg 170.
Gravel and crushed rock	230	146	Mainly from West Europe.
Quartz and quartzite	289	603	Italy 317.
Sand, excluding metal bearing	46,676	54,888	Belgium-Luxembourg 49,642.
Sulfur:			
Elemental, all forms	48,514	42,900	France 42,854.
Sulfur dioxide	10,436	NA	
Sulfuric acid	39,393	22,351	Italy 15,055; France 3,611.
Talc, steatite, soapstone, and pyrophyllite	182	1,327	France 1,151.

See footnotes at end of table.

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Table 3.—Greece: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Other nonmetals, n.e.s.:			
Crude	258	211	Mainly from West Europe.
Oxides and hydroxides of magnesium, strontium, and barium.	38	48	Do.
Bromine, iodine and fluorine	5	NA	
Building materials of asphalt, asbestos and fiber cement and unfired nonmetals.	461	867	Austria 176; Netherlands 92.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	1,081	952	Italy 726.
Coal, all grades, including briquets. thousand tons	136	116	Poland 39; U.S.S.R. 37; West Germany 30.
Coke and semicoke do	262	128	West Germany 73; Czechoslovakia 22; Italy 18.
Gas, natural	4,699	14,891	Italy 14,253.
Hydrogen, helium, and rare gases	145	96	Mainly from West Europe.
Petroleum:			
Crude and partly refined thousand tons	3,113	3,992	Saudi Arabi 1,694; Iraq 763; U.S.S.R. 671; Iran 485.
Refinery products:			
Gasoline, including natural do	166	97	U.S.S.R. 63; United Arab Republic 21.
Kerosine and jet fuel do	7	16	Italy 11.
Distillate fuel oil do	478	457	U.S.S.R. 144; Italy 98; United Arab Republic 89.
Residual fuel oil do	818	591	U.S.S.R. 298; Italy 83; France 66.
Lubricants do	38	43	France 10; Netherlands 9; United Kingdom 9; Italy 8.
Other:			
Petroleum coke do	11	28	United States 23; France 4.
Other do	r 5	8	West Germany 6.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Greece's sole primary producer, Aluminium de Greece S.A. (ADG), launched an expansion program at its 2-year-old Distomon plant near Antykira Bay, raising total investment in the plant to $166 million. The initial alumina capacity of 250,000 tons was increased to 275,000 tons by yearend and a capacity of 450,000 tons was proposed by 1970. Aluminum ingot capacity, originally 75,000 tons, was expanded to 83,000 tons by yearend. Proposed ingot capacity for 1970 was 90,000 metric tons. As the nation's electric power facilities are limited, capacity for alumina production is increasing at a greater rate than aluminum capacity, permitting further growth in alumina exports, estimated at 50,000 tons in 1968.

About 85 percent of 1968 ingot output was exported, principally to France and Belgium. In addition to expanding metal production facilities, ADG has extended into bauxite mining operations and aluminum fabricating facilities by acquiring ownership in Delphi Bauxites, S.A., and in Viohalco Aluminum, S.A.

The construction of a second reduction plant with probable location at Messolonghi was under consideration. Possibly financed by Aristotle Onassis at $250 million, the refinery will have an annual capacity of 500,000 tons of alumina and 120,000 tons of aluminum in 1978. Fifty percent of total capacity will be achieved by 1975.

Proven domestic bauxite reserves at more than 50 million tons will sustain the expanded alumina and aluminum output for a number of years. In addition, considerable exploration work was conducted by Bauxitai Parnassou, Bauxitai Eliconos, and Bauxitai Barlos Hellas. The Eleusis Bauxite Mining Company, producing nearly a quarter of the total 1968 bauxite production, discovered a bauxite belt on the slopes of Mount Oiti. A conservative preliminary estimate of the deposit was 5 million tons.

Lead.—Compagnie Francaise des Mines du Laurium launched a modernization program at its Laurium smelter with an eventual goal of increasing capacity to 20,000 tons annually. Raw material for the smelter includes mixed lead-zinc-silver sulfide ores from the Laurium mine and imported lead

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concentrates principally from Morocco. Silver is also recovered domestically, zinc is exported in concentrates. Further exploration of the Laurium deposit was conducted during the year but no significant results were reported.

Nickel.—The Larco (Mining and Metallurgical Company of Larymna, S.A.) nickel smelter began production of electrolytic nickel after 1967 test runs proved successful. The entire smelter output of ferro nickel and electrolytic nickel valued at $16 million was exported. The Larco plant has capacity for production of 50,000 tons of steel billets as a byproduct of processing domestic laterite ores.

Uranium.—Government sponsored exploration for uranium was conducted in Macedonia and Thrace. Exploratory drilling was completed near Vathi, Kilkis Nome. On the basis of three 100-meter-depth and one 200-meter-depth test holes, the uranium bearing ore deposit was estimated at 25 million tons. Further studies were undertaken for quality and exploitability.

During 1968 four U.S. firms (Susquehanna Corp., General Refractories Co., Jack Gynberg Associates, and International Mineral Engineers) expressed interest in exploration and development of Greek uranium deposits. No concession agreements have as yet been reached.

Interest in uranium exploration has been spurred by the Greek Government decision to install a nuclear-energy powerplant of 300- to 500-megawatt capacity. Representatives from the United States, United Kingdom, and West Germany have expressed interest in construction of the nuclear powerplant.

NONMETALS

Cement.—The 4-million-ton output in 1968 virtually balanced consumption requirements for cement. Anticipating future consumption growth to 4.2 million tons in 1969 and 6 million tons in 1975, several major producers announced expansion and development programs during the year. The General Cement Co., S.A., investing $17 million in 1970–73, plans installation of a 2,500-ton-per-day-capacity kiln at its Volos plant, as well as the expansion and modernization of its Drapestona plant and distribution centers at Thessaloniki, Rion, and Heraklion. The Titan Cement Co. announced a $7.3 million investment in plant expansion and improvements, a new grinding mill, and the development of new limestone quarries.

The Hellenic Cement Company placed the $8 million Drepanon cement manufacturing plant in operation in late 1968. The plant's productive capacity is 350,000 tons of gray portland, high-early-strength, and masonry cement.

Magnesite.—Greece's leading magnesite producer and exporter, Société Financiere de Grèce S.A. (SFG) commissioned a third rotary kiln in 1968, raising annual capacity from 60,000 to 100,000 metric tons at the Mantoudi operations on Euboea Island. Other SFG expansion programs underway include the construction of an ore dressing plant at Paraskevoremma and the expansion of the ore dressing plant at Kakavos.

MINERAL FUELS

Lignite.—Lignite, Greece's only mineral fuel resource, is mined principally at Ptolemais, Aliveri, and in Megalopolis. Extensive development has been undertaken to triple production to 15 million tons by 1973. Most of the development work is centered at Megaloupolis where a West German consortium headed by Allgemeine Elektricitaets Gesellschaft (AEG) has invested $85 million to develop the 400-million-ton reserve deposit and establish a 250,000 kilowatt capacity power station. The power station will consume 4.5 million tons of lignite annually generating 1.5 million kilowatt-hours annually. The mines and powerplant are scheduled to be operational by mid-1970.

A 17-kilometer conveyor belt and a 4,500-cubic-meter-per-hour capacity loader was installed at the Ptolemais lignite mine increasing productive capacity of the mine by 40 percent. Exploration at Ptolemais proved an additional 400 million tons, bringing total reserves there to 750 million tons.

About 75 percent of total lignite mined is consumed in electric power generation, about 15 percent in the production of nitrogenous fertilizers, and the remainder is used in lime kiln operations and domestic heating.

Petroleum.—Product output at the Esso-Pappas Thessaloniki refinery totaled more than 2.6 million tons, up over 20 percent from 1967 output. Output at the Govern-

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ment owned refinery at Aspropyrgos totaled more than 1.7 million tons, 10 percent below its 1967 level. The decline was partially attributable to the uncertainties evolved from expansion and modernization plans and the appointment of a new lessee with the expiration of the Mobil Oil Company lease in August.

This refinery's capacity is to be expanded from 1.9 million tons to 3.2 million tons by 1970. Mobil Oil Corporation, Shell Oil Co., British Petroleum, and the Refinery Services, S.A., signed a contract to supply 25 million tons of crude during 1968–80. The companies agreed to provide or obtain a $20 million loan and provide technical and consulting work for the refinery expansion program.

A third refinery, with a projected 7-million-ton capacity, was under consideration; however, no contract award was made by yearend.

Texaco Overseas Petroleum, Co., concluded an offshore exploitation agreement covering a territory of 5,000 square kilometers in the Thermaic Gulf and an investment of $7 million.

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The Mineral Industry of Hungary

By Joseph B. Huvos [1]

Hungary produces few minerals; bauxite was the only significant one by world production standards. The production of mineral fuels and iron and steel were important only for Hungary's domestic economy. Consumption of minerals other than bauxite, alumina and low rank coal, was much larger than domestic production, necessitating substantial imports of these items.

The contributions of the mineral industry to the Hungarian social product [2] was about 5.5 percent in 1967, the latest year for which such data were available. Roughly 10 percent of the industrial labor force, or 149,500 persons, were employed in the mineral industry.

Major events during 1968 included the opening of Europe's largest bauxite mine at Halimba; the commissioning of the Borsod ore dressing plant for the processing of Krivoy-Rog ores imported from the U.S.S.R.; the construction of a basic oxygen converter in Dunaújváros; the commissioning of an enlarged nitrogen fertilizer plant at the Tisza Chemical Combine; development work on the Gyöngyös Visonta coal mine; and the commissioning of a new 2-million-ton atmospheric distillation unit at the Százhalombatta refinery.

[1] Foreign mineral specialist, Division of International Activities.

[2] As in other Communist countries of East Europe, Hungary does not report on its gross national product (value of all final goods and services produced) but rather publishes a figure for the social product, which generally excludes items such as banking fees, rent, education, defense, public administration, and health services.

PRODUCTION

Production of brown coal (lignite), Hungary's most important mineral, remained practically unchanged. The mines were mostly of the underground type and productivity was relatively low because of a low level of mechanization. The production of bauxite, Hungary's most important export mineral, increased by about 20 percent. More than 85 percent came from underground mines owing to depletion of surface deposits.

Oil production came chiefly from pumped wells. Fracturing and acidizing techniques were used, but secondary recovery operations remained minimal. The Soviet-designed turbodrill was used on about 70 percent of the gas and oil drilling rigs in operation.

Many plants and facilities of the country's mineral industries were of Soviet design or origin. However, a tendency towards purchasing highly developed processes and equipment from Western countries could be noted.

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Table 1.—Hungary: Production of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite—thousand tons	1,477	r 1,477	1,429	1,650	1,959
Alumina	245,917	267,000	288,000	327,948	381,000
Metal:					
Ingots	56,874	58,099	60,496	61,796	63,088
Semimanufactures unalloyed, rolled	17,615	16,769	17,094	17,264	NA
Semimanufactures alloyed, rolled	5,050	6,242	7,124	8,646	NA
Iron and steel:					
Iron ore—thousand tons	775	762	747	715	638
Pig iron:					
For steel	1,404	1,513	1,584	1,645	1,625
For foundry—thousand tons	89	69	62	r 10	13
Ferroalloys—do	6	7	7	NA	NA
Steel ingots—do	2,365	2,520	2,648	2,739	2,903
Rolled products:					
Bars, rods, shapes, sections—do	822	866	870	1,778	1,983
Concrete reinforcement bars—do	109	86	107		
Manganese ore	171,196	213,000	210,000	209,000	209,000
NONMETALS					
Bentonite	98,384	107,000	91,000	84,000	84,000
Cement—thousand tons	2,257	2,383	2,601	2,656	2,801
Dolomite	482,114	560,000	622,000	651,000	NA
Fertilizer materials:					
Nitrogenous substance, 20.5 percent	448,762	724,119	816,000	917,000	1,196,000
Phosphatic:					
Gross weight	543,545	615,431	715,000	824,000	846,000
Phosphorous pentoxide (P_2O_5) content	99,931	117,000	131,000	153,000	157,000
Kaolin	50,338	54,000	r 62,000	66,000	66,000
Lim., calcined	735,629	709,104	773,000	800,000	733,000
Quartzite	42,360	40,000	39,900	39,000	39,000
Sulfur, elemental	3,099	3,450	3,521	3,500	NA
Sulfuric acid	322,000	378,000	393,000	424,440	446,000
MINERAL FUELS					
Coal:					
Bituminous—thousand tons	4,125	4,362	4,360	4,053	4,242
Brown—do	22,363	22,190	21,563	19,591	19,881
Lignite—do	5,060	4,885	4,425	3,385	3,090
Coke:					
Metallurgical—do	665	642	646	649	500
Other (including breeze)—do	544	605	598	549	NA
Fuel briquets—do	1,301	1,340	1,352	1,068	NA
Gas:					
Natural—million cubic feet	29,275	41,313	57,958	72,218	95,031
Manufactured—do	16,878	18,673	18,681	20,165	NA
Petroleum:					
Crude—thousand tons	1,801	1,802	1,705	1,686	1,807
Natural gasoline	22,037	20,762	60,137	63,000	NA
Refinery products:					
Gasoline—thousand tons	370	445	560	607	729
Kerosine—do	38	21	19	2	NA
Diesel fuel—do	970	1,045	1,236	1,261	1,391
Heating oil—do	1,642	1,725	1,722	1,801	1,969
Lubricants:					
Oils—do	111	106	r 70	78	NA
Greases—do	19	19	19	22	NA
Paraffin, crude	5,520	5,655	5,291	7,386	NA
Bitumen, natural and refinery—thousand tons	455	450	514	580	NA

p Preliminary. r Revised. NA Not available.

[1] In addition to reported commodities, Hungary is known to produce arsenic, copper, gold, lead (mine and smelter), silver, uranium, zinc (secondary), diatomite, and peat.

Sources: Központi Statisztikai Hivatal (Office of Statistical Council). Statisztikai Évkönyv 1967 (Statistical Yearbook for 1967), Budapest 1968, 320 pp. for years 1963 through 1967. Figures for 1968 were taken from U.S. Foreign Service dispatches from the U.S. Legation Budapest and Bureau of Mines files.

TRADE

During 1967 the pattern of Hungary's foreign trade in mineral commodities did not change substantially. The country imported most of its mineral requirements, such as nonferrous base metals, iron ore, high rank coals, coke, and crude petroleum. Bauxite, alumina, manganese ore, and various semimanufactured products were

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exported. Hungary's principal trading partner was the U.S.S.R., which provided most of the fuels, iron ore, and metals in exchange for alumina and other semimanufactured and finished products. Trade with the U.S.S.R. and East European countries accounted for almost 70 percent of Hungary's foreign trade.

Table 2.—Hungary: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite thousand tons	621	668	Czechoslovakia 251; East Germany 228; Poland 108.
Alumina do	175	247	Poland 107; U.S.S.R. 89; East Germany 18.
Ingots	15,184	19,626	United Kingdom 14,464; Czechoslovakia 2,104; Rumania 500.
Scrap [2]	8,194	NA	
Copper, scrap	782	NA	
Iron and steel:			
Pig iron	79,575	79,496	NA.
Rolled products, excluding pipes. thousand tons	580	507	Czechoslovakia 90; Rumania 40.
Pipes and fittings	64,892	54,286	Yugoslavia 7,844; Poland 5,471; Austria 4,733.
Lead ores and concentrates [2]	8,195	NA	
Manganese ore [2]	42,946	NA	
Zinc, ores and concentrates [2]	2,450	NA	
NONMETALS			
Cement thousand tons	330	247	NA.
Clays, all kinds [2]	19,179	NA	
Infusorial earths [2]	11,915	NA	
MINERAL FUELS			
Coke [2]	101,898	NA	
Petroleum refinery products:			
Gasoline thousand tons	163	213	NA.
Diesel fuel [2] do	160	217	NA.
Heating oil do	316	452	NA.
Lubricants	13,709	14,148	NA.
Bitumen thousand tons	201	181	NA.

NA Not available.

[1] Because Hungary publishes only limited data on foreign trade, this table has been compiled from Hungarian and United Nation sources. Much information is partial and unless noted is from Statisztikai Evkönyv 1967 (Statistical Yearbook 1967), Budapest 1968, 320 pp.

[2] Source: Statistical Office of the United Nations.—New York, 1967.

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Table 3.—Hungary: Imports of selected mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources in 1967 [2]
METALS			
Aluminum ingots	[2] 2,500	[3] 4,700	U.S.S.R. 4,700.
Cadmium	[2] 9	[3] 30	U.S.S.R. 30.
Chromite	[3] 23,000	[3] 11,000	U.S.S.R. 11,000.
Copper and copper products	[3] 10,429	[3] 8,952	U.S.S.R. 8,700; Belgium 252.
Iron and steel:			
Iron ore—thousand tons	2,696	2,808	NA.
Pig iron—do	131	163	NA.
Ferroalloys—do	r 29	26	NA.
Semimanufactures excluding pipes—do	r 199	149	NA.
Lead, refined	[2] 9,800	[3] 9,500	U.S.S.R. 9,500.
Tin—long tons	1,452	1,205	NA.
Zinc	14,408	13,296	U.S.S.R. 3,000; Belgium 360.
NONMETALS			
Asbestos	14,681	14,114	U.S.S.R. 12,200.
Cryolite	1,200	[3] 1,000	U.S.S.R. 1,000.
Clay, calcined	66,935	64,965	NA.
Copper sulfate	9,192	11,776	U.S.S.R. 4,777; Yugoslavia 2,409; West Germany 1,399.
Fertilizers manufactured:			
Nitrogenous—thousand tons	269	213	Austria 184; U.S.S.R. 22.
Potassic—do	286	336	East Germany 189; U.S.S.R. 99; Israel 48.
Phosphatic—do	110	136	U.S.S.R. 120.
Fire clay	[2] r 62,589	64,925	NA.
Graphite	1,100	[3] 1,500	U.S.S.R. 1,500.
Magnesite, calcined	78,180	75,777	NA.
Pyrites, bulk—thousand tons	154	176	U.S.S.R. 156.
Phosphate rock—do	403	494	NA.
Salt, all kinds—do	263	275	NA.
Sulfur, elemental—do	151	168	U.S.S.R. 64; West Germany 12.
Sulfuric acid—do	67	87	U.S.S.R. 80.
MINERAL FUELS			
Briquets	503	521	NA.
Coal, all kinds—thousand tons	2,384	1,742	NA.
Coke—do	1,200	1,156	U.S.S.R. 594; Czechoslovakia 282; Poland 280.
Gas, natural—million cubic feet	r 7,063	7,063	All from Rumania.
Petroleum:			
Crude—thousand tons	2,911	2,951	NA.
Refined products:			
Gasoline—thousand tons	56	71	NA.
Diesel fuel—do	131	130	U.S.S.R. 124.
Heating oils—do	262	346	All from U.S.S.R.
Lubricants—do	24	23	NA.

r Revised. NA Not available.

[1] Because Hungary publishes only limited data on foreign trade in minerals, this table has been compiled from Hungarian and Soviet sources. Much information is partial, and unless noted, is from Statisztikai Évkönyv 1968 (Statistical Yearbook 1967), Budapest 1968, 320 pp.

[2] Source: Vneshnyaya Torgovlya S.S.S.R. za 1967 god (Foreign Trade of the U.S.S.R. for 1967). Moscow 1968, 312 pp.

[3] Partial figure.

COMMODITY REVIEW

METALS

Bauxite and Aluminum.—In 1968 Hungary was a major European bauxite producer with an output of almost 2 million tons. Less than one-seventh of the bauxite was used locally to manufacture about 63,000 tons of aluminum. The primary reason for this was the lack of low cost electric power. Hungary imported 16 percent of its electric power requirements, mainly from the Soviet Union with lesser amounts from Czechoslovakia. However, primary aluminum capacity is to be increased to 130,000 tons by 1975. To satisfy domestic demand, Hungary concluded a barter agreement with the U.S.S.R. in 1962, under which the U.S.S.R. agreed to provide Hungary with increasing amounts of aluminum made from Hungarian alumina; the U.S.S.R. delivered 70,000 tons of aluminum in 1968 and deliveries should reach 165,000 tons in 1980.

Europe's largest bauxite mine with a designed annual productive capacity of

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600,000 tons of bauxite was opened at Halimba during the year.

Hungary plans to invest $42.5 million[3] in bauxite mining from 1970 to 1975 to raise production to 3.2 million tons per year. Alumina production is also to be increased to 470,000 tons by 1970.

A modern French aluminum hydrate calcining furnace was under test at the Almásfüzitö alumina factory during 1968.

At the village of Apc, a light metal foundry was being expanded into an aluminum plant where 1,200 workers will produce 5,500 tons of castings and 2,000 tons of ingots each year. The new plant will represent an investment of $17 million.

At the Székesfehérvár Light Metal Manufacturing Works construction started on a new aluminum strip mill, designed by the Budapest Aluterv and Soviet Givproavioprom Engineering Bureau. Installation was proceeding on a 1,700-millimeter, four-high hot rolling mill and two four-high cold rolling mills. Capacity will be 20,000 tons per year by 1970 and will be later expanded to possibly 150,000 tons.

At the Tisza Chemical Combine in Szolnok, full production was reached at Hungary's first synthetic cryolite plant. Design capacity of the plant was not given.

Regular production of gallium, a by-product of alumina, was started at the Ajka Gallium plant. Production figures were not reported.

At the Magyaróvár alumina plant, production of alum was planned for 1969 and production of aluminum sulfate for 1971; design capacities were not published.

Iron and Steel.—About four-fifths of the iron ore used by the Hungarian steel industry was imported from the U.S.S.R., the remainder being of domestic origin.

During the year, the Borsod iron ore dressing plant with an annual capacity for treating 1.5 million tons of ore began production. The plant processed Soviet ore from Krivoy-Rog. It was planned to double annual output to 3 million tons by 1971. At the iron and steel works in Dunaújváros, construction began on a basic oxygen converter with Soviet equipment and an electric steel furnace.

Plans were made to construct a new foundry in Györ in 1969. An 18,000-ton-per-year furnace is scheduled for commissioning in 1971.

Mercury.—Cinnabaryte deposits assaying 0.2 to 1.5 percent mercury were discovered near Sárospatak; it was claimed that reserves exceeded domestic requirements considerably.

Uranium.—The discovery of new uranium deposits of undisclosed size was reported in the Badacsony area near Kövágóörs, Köveskál, and Badacsonytomaj. The uranium ores in the Mecsek Mountains were reportedly of the uranium oxide-pyritic type, containing secondary uranium. It is the secondary ores, accumulated in sandstone, which were mined.

NONMETALS

In 1968 Hungary was self-sufficient in cement, lime, clays, and bentonite and exported cement to Yugoslavia. A number of nonmetallic minerals such as asbestos, cryolite, phosphate rock, salt, sulfur, and pyrites had to be imported to meet domestic needs.

Corundum.—Artificial corundum, or fused alumina, was manufactured on a small scale at the Magyaróvár alumina plant during 1968. A 6,600-ton-per-year plant was under construction at the same location and was due for commissioning in mid-1970.

Fertilizers.—The Chemocomplex Company of Budapest ordered a $1.25 million ammonia synthesis plant with a capacity of 66,000 tons per year from the Federal Republic of Germany. The plant will be located at the site of the Borsod Chemical Works in Kazincbarcika. The completion date is set for 1969.

In November 1968 the enlarged nitrogen fertilizer factory of the Tisza Chemical Combine started operations. The U.S.S.R. supplied credit, equipment, and engineering plans for the expanded plant.

Magnesite.—A $2 million experimental synthetic magnesite plant of unknown capacity was under construction at Tiszavárkony, Szolnok County. Hungarian basic refactory bricks have penetrated the West German and Italian markets.

MINERAL FUELS

Hungary's reliance on imported mineral fuels, mainly from the U.S.S.R., increased

[3] Calculated at a rate of $1=23.48 forints.

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further during 1968. Although low rank coal remained the principal source of energy in the country, natural gas and petroleum continued to increase their share. The share of gas and oil which was 28 percent in 1965, had increased to 40 percent in 1968.

Coal.—The output of coal amounting to approximately 27.2 million tons, remained almost unchanged from 1967. Much of the lignite was produced in underground mines by longwall methods. Automation was still limited and cost analysis studies were made for these operations. In Hungary, underground mining costs are higher than elsewhere in Europe mainly because geological conditions do not permit intensive mechanization. These conditions were expected to become worse as the depths of the mines increase.

Mining costs should be much lower at the new open cast mine in the Gyöngyös Visonta area at the foot of the Mátra Mountains. Development of this mine has continued to progress and the first lignite was to be delivered by February 1969. Production from this mine will feed the initial 100-megawatt generating unit of the new power station erected in the vicinity. The lignite was previously considered too poor in quality to be used economically. The mine is expected to produce 500,000 tons in 1969 and to supply one-quarter of Hungary's total lignite output by 1971. It is estimated that reserves are sufficient to supply the power station for 35 years.

Natural Gas.—Natural gas production increased substantially in 1968. The increased production came from new wells in the Alföld and, in particular, the Szeged region. Estimated recoverable reserves were 882 billion cubic feet. Hungarian natural gases contain varying amounts of carbon dioxide. Gases containing 30 percent or less carbon dioxide were used in industry and households, as well as in power stations to provide a steady base load. Natural gases containing up to 70 percent carbon dioxide are used on an experimental basis mainly for glass and ceramics manufacture. Gases containing carbon dioxide in excess of 90 percent are used for the production of carbon dioxide.

Hungary continued to construct a gas distribution network, which was interconnected with the Czechoslovak system. The country will also import some natural gas from the U.S.S.R. via the 325-mile Soviet-Czechoslovak pipeline commissioned in 1967; it has a designed capacity of 35 billion cubic feet per year and feeds the Slovakian chemical enterprises. Until completion of Hungary's gas distributing system, production of manufactured gas continues with the replacement of coal by oil for gas making.

Experiments proved the feasibility of storing gas in lenticular beds in the Oligocene sandstone northeast of Budapest and in oil-gas deposits at Budafa in the southwest of Hungary. Establishment and use of these underground storage facilities will become necessary only after 1975; until then, facilities situated above ground will suffice.

Seven billion cubic feet of natural gas are imported yearly from Rumania to feed the Tiszapalkonya Chemical Combine.

Petroleum.—*Drilling and Production.*—According to the latest available information, drilling decreased during 1960–66 from 383.9 to 316.2 thousand meters; the number of rigs fell from 203 to 150; and the average depth of the wells increased from 1,888 to 2,064 meters.

Although crude oil production decreased in 1968, in the Nagykanizsa-Zalaegerszeg region, increasing amounts of crude were produced in the Szeged area, the output of which reached about 200,000 tons in 1968. According to plans, full capacity of this area should be reached in 1970 when 1 million tons of crude oil and 35 million cubic feet of natural gas and other products are delivered. In an area of about 10 square miles, 600 wells are to be drilled.

Refining.—Refinery throughput in 1968 totaled approximately 5 million tons of crude. The crude came from the Szeged region and from the U.S.S.R. via the Friendship pipeline. Hungary plans to have a total crude refining capacity of 9.2 million tons by 1973.

Additions during 1968 to the Százhalombatta refinery, Hungary's largest, were as follows: In September 1968 test operations were started on a new 2-million-ton-per-year distillation tower. The basic equipment came from the U.S.S.R.; the furnaces were furnished by Czechoslovakia; the instrumentation was manufactured in France; and the rest of the equipment was made in Hungary. In Százhalombatta, a

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catalytic reforming plant was started in November 1968 for the production of several hundred thousand tons of regular and high-test gasoline per year. A second 120,000-ton-per-year dewaxing unit went into operation. Plans were also completed at the same place for an atmospheric distillation unit with an annual capacity of 3 million tons; a diesel fuel desulfurizing unit; and a bitumen manufacturing unit. Crude for the new distillation facility will be obtained from the Romashkino oilfield in the U.S.S.R.

Another 16 plants are to be built here for further processing of oil products.

Trade and Distribution.—Oil imports from the U.S.S.R. came via the Friendship pipeline which currently has a carrying capacity of 4.5 to 5 million tons per year. Plans were made to lay a second 186-mile line into Hungary, which is expected to be completed by 1972. The two pipelines will have a carrying capacity of 9 to 12 million tons per year.

Hungary has concluded an agreement with Iran for the exchange of $50 million worth of Iranian crude oil for Hungarian machinery and manufacturing plants.

Shell International concluded a distribution agreement with Hungary during the year. In 1969 ten Shell retail gas stations will be built in the country to sell gasoline, lubricants, and spare parts.

Atomic Energy.—A second nuclear reactor was being constructed at the Polytechnical University of Budapest, where personnel will be trained to operate Hungary's first 80-MW nuclear power station at Paks on the Danube. The plant was built with Soviet aid and will soon be commissioned.

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The Mineral Industry of India

By Charles L. Kimbell[1] and Charles W. Sweetwood[2]

India's mineral industry in 1968 showed a general improvement relative to its 1967 performance, as the nation's recessionary trend of the past few years showed signs of abatement. While crude mineral production and exports of mineral commodities including processed forms generally increased, and imports of mineral commodities declined, there remained considerable underutilization of capacities in major industries, notably iron and steel plants, coal mines, cement plants, and nonferrous metals processing units that supply Indian engineering industries.

Domestic mineral industry activity was reflected not only in production increases, but in larger exports, major exploration programs, continued investment in new facilities, and to some extent, by reduced imports (in cases where domestic output supplanted imports).

While statistical data were not available for 1968, it is believed that the contribution of mining and quarrying to the national economy was in terms of dollars somewhat greater than the 1.06 percent of total, $345 million[3] contribution to the net domestic product recorded for the Indian fiscal year ending March 31, 1967. This supposition is borne out by preliminary reports showing that mining and quarrying contributed about 1.1 percent to the country's national income of $39.12 billion for the fiscal year ending March 31, 1968, and by the general upturn in mineral output and in overall economic activity in calendar 1968. In addition to the contribution of mining and quarrying, mineral processing (included statistically in Indian sources as an inseparable part of "large-scale manufacturing") presumably made a contribution several times greater than that for mining and quarrying alone. Thus, the nation's total mineral industry contribution to net domestic product apparently was of the order of 4 to 6 percent.

With regard to trade value, trade in mineral commodities moved markedly closer to a position of balance, with imports down by $119 million to about $515 million and exports up by $94 million to $385 million.

Despite the fact that a number of mineral industry facilities operated below rated capacity in 1968 (in part owing to lack of markets), efforts to increase productive capacity continued in the case of several commodities. Such increases were in line with planned capacities set forth by the Government of India Planning Commission. In a number of instances in recent years, these goals for planned capacities have not been fully met, and in some cases, even when goals were not achieved, the expansion actually achieved was more than adequate to meet actual demand. For example, in the steel industry, targeted capacities, revised downward several times from those set in the original fourth 5-year plan, were not completed by 1968; yet several plants had idle capacity in that year, and exports were increased beyond originally planned levels to move steel out of the domestic market. Similarly, in aluminum, attainment of rated capacity goals and operation of plants at this level led to production of surplus metal from the domestic market viewpoint.

Current plans for further steel production capacity increases and for attendant increases in iron ore output appear to some analysts to be excessive in light of past performance.

The mining and crude petroleum sectors of India's mineral industry employed about 671,000 persons in 1967 (latest data avail-

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[3] Where necessary, values have been converted from Indian Rupees (Rs) at the rate of RS1 = US$0.133.

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able), of whom about 60 percent were engaged in coal mining, 8 percent in iron mining and limestone quarrying, 7 percent in manganese ore mining, and 3 percent in mica operations. An additional 243,000 persons worked in nonmetals product plants (such as brickworks, cement plants, and glass plants), 227,000 persons were engaged in iron and steel production and 49,000 in nonferrous metals plants. Thus, mineral industry operations employed over 1,190,000, or about 7 percent of the national industrial labor force.

Labor relations remained disturbed during 1968. However, there were some improvements. In coal mines, 174 strikes and two lockouts resulted in the loss of 350,000 man-days, compared with 233 strikes, seven lockouts and 755,000 man-days lost in 1967. In other than coal mines and oilfields, however, 400,000 man-days were lost as a result of 107 strikes, compared with only 100,000 man-days lost in 1967. There were indications that 1969 would be marked with increasing labor problems.

Active mining operations numbered over 2,800, including 778 coal mines, 605 mica mines, 300 iron mines, 295 manganese mines, 289 limestone quarries, 122 china clay operations, 94 steatite mines, and 93 gypsum mines. These eight commodities accounted for over 90 percent of all mines reported.

Mineral commodity transportation in India, both of crude minerals and mineral products, continued to depend heavily on the Government-owned Indian Railways system. This system, with four different rail gages, much outmoded rolling stock (including engines) and considerable lightweight trackage contributed to high mineral prices to consumers as well as to occasional shortages at domestic consuming centers. However, impact on local consumers was far less significant than delays in meeting export commitments. Ores for domestic consumption rarely move great distances from mine to plant, but most of the export ores must be hauled up to 500 kilometers. Numerous delays in such shipments have been noted owing to stackups of full cars at mines and empty cars at ports, as well as to problems relating to transfer of ore from cars of one gage to those of another.

Truck transport remains restricted generally to hauls from mines to railheads because of poor roads and insufficient vehicles. Notwithstanding the rail haulage problems, inadequate port facilities remained the foremost limitation to expansion of mineral exports, particularly iron ore. Plans for port improvement that are now underway will have to be completed on schedule if projected export sales are to be achieved.

The Government of India in 1968 continued to expand the role of public sector operations in the mineral industry, in keeping with a long range policy to make the public sector operations dominant. Non-Indian involvement in new ventures continued through 1968 to consist chiefly of contractural arrangements for services to government enterprises, and, to a lesser degree, to joint foreign private-Indian Government operations. The limited available private capital in India, even that in the hands of firms now engaged in mineral operations, did not appear to be used for development of major new facilities. In some instances, individual Indian State Governments invested state funds in mineral industry ventures. Their effort, however, was overshadowed by Central Government investments in national corporations, most notably in steel, petroleum, iron ore, coal, aluminum, and copper.

Mineral exploration activity in 1968 continued at a rapid pace. The flying phase of the U.S. Agency for International Development (USAID)-sponsored nonferrous metals-oriented airborne geophysical survey, "Operation Hardrock," was completed during the year and the surface (drilling) phase of the program is currently underway with early efforts being directed toward important anomalies identified in the Khetri area of Rajasthan. A United Nations (UN)-aided nonferrous metals airborne geophysical survey (similar to the Operation Hardrock concept, and begun in 1967) continued throughout 1968. The aerial survey phase of the project was completed by midyear and followup ground investigations were initiated immediately. New discoveries include interesting lead-zinc-copper deposits in the Mamandur area of South Arcot District, Tamil Nadu (Madras), estimated at 1 million tons of ore with a total metal content of 5 percent, and vermiculite deposits in the Tirupattur area of North Arcot District. Reports also claim that this project has identified iron ore, columbium, and other rare-earth ele-

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ments, and radioactive minerals in the North Arcot District. Further, UN ground parties are presently making detailed economic studies of previously known occurrences of iron ore, magnesite, and bauxite in the vicinity of Salem in Tamil Nadu.

The USAID-sponsored phosphate exploration program ("Operation Softrock") in Uttar Pradesh continued during the year, focusing largely upon stratigraphic correlation, drilling, underground development of the known orebodies, and metallurgical beneficiation studies (at the Indian Bureau of Mines laboratories, Nagpur, Maharashtra, and under the supervision of a U.S. Bureau of Mines phosphate metallurgical specialist). Preliminary results indicate that the Uttar Pradesh phosphates may ultimately prove to be limited as to total recoverable reserves and marginal as to beneficiation characteristics and economics.

Onshore exploration for oil and gas was accelerated during the year, exceeding the 1968 drilling target set a year ago. The Oil and Natural Gas Commission (ONGC) had hoped to complete 276,000 meters of exploration drilling during 1968, and reportedly logged 287,874 meters in 124 wells —a new high in performance and achievement. Extensions to known structures in Gujarat and Assam were indicated, and several holes completed in Rajasthan, West Bengal and Assam show interesting possibilities for the development of new oil structures. However, substantive data on most of the work completed in 1968 will not be made available until additional field tests have been completed; a "major" discovery was not recorded during the year. ONGC announced that its first attempt at offshore drilling for oil and gas would be postponed until 1970.

In contrast to production expansion programs for other commodities, development of copper, lead, and zinc deposits and metallurgical facilities to process these ores, as well as of a domestic source for sulfur were given relatively little attention in announced development plans. This prevailed despite sizable annual expenditures necessary for importation of these commodities.

The Minerals and Metals Trading Corporation, a government entity, continued to monopolize exports of iron ore, manganese, and coal (except iron ore from Goa), and was also involved in exports of ferromaganese, bauxite, and chromite, as well as in imports of nonferrous metals. The State Trading Corporation, another Government entity, exported cement and salt and controlled imports of sulfur, phosphate rock, and mercury.

There were indications that the Indian Government might nationalize imports of all mineral raw materials, in order to more effectively control foreign trade expenditures and, through bulk buying, lower unit costs, but at yearend 1968 no formal action had been taken.

There was considerable government effort to stimulate mineral commodity exports, not only of traditional items such as iron ore, manganese ore, and mica, but also of bauxite, coking coal, cement, aluminum, and steel shapes. In some cases, exports were apparently aimed primarily at reducing temporary domestic oversupply, but in other cases, a serious effort to develop permanent foreign markets primarily for potential earnings seemed the primary intent.

At yearend, a new revised fourth 5-year plan (April 1, 1969–March 31, 1974) was in the process of being prepared, but had not been officially released. Some indications of production targets and investments that were to be proposed had come to light, but formal examination of and action upon the plan by the legislative branch of India's Central Government was not due until some time in 1969. The original fourth 5-year plan, proposed to cover the period April 1, 1966–March 31, 1971, was voided shortly after its inception, and was replaced by three intirim 1-year plans.

PRODUCTION

The overall 5.1 percent increase registered for the value of crude mineral production in India between 1967 and 1968 reflected an increase in output of most major and many minor commodities rather than phenomenal growth for a few selected items. Although the growth in terms of value was distributed in roughly equal amounts between metals, nonmetals, and mineral fuels, the growth rates for fuels at 1.9 percent was far below the 14 and 20 percent rates recorded for metals and non-

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metals, respectively. The following tabulation summarizes crude mineral output value by major commodity groups.

Commodity group	Million dollars	
	1967	1968
Metallic minerals:		
Ferrous	45.27	50.13
Nonferrous	12.05	15.02
Subtotal	57.32	65.15
Nonmetallic minerals	39.89	47.76
Mineral fuels:		
Bituminous coal	265.21	269.52
Lignite	10.16	10.45
Petroleum, crude [1]	61.18	63.15
Subtotal	336.55	343.12
Total	433.76	456.03

[1] Estimated, applying a value of $1.45 per 42-gallon barrel produced.

Among the metals, iron ore, gold, and chromite together accounted for 90 percent of the value increase for that group; individual increases and 1968 value of production for these were iron ore up $3.85 million to $35.07 million, gold up $2.37 million to $8.58 million, and chromite—nearly doubling—up $82,000 to $1.76 million.

In the case of crude nonmetals, the growth in output value was chiefly the result of increases both in tonnage and in the unit price of major items. Limestone with only a 7 percent tonnage increase in 1968 was credited with a 16-percent value increase, while salt output gained 12.4 percent quantitatively and 25.6 percent in value; these two commodities accounted for over 70 percent of the overall growth in crude nonmetal output value.

Among mineral fuels, crude oil, with a 3.2-percent increase in estimated value, showed the greatest growth rate, but solid fuels had a greater increase in dollar value, as the 1967 base figure was much higher than that for oil.

Table 1.—India: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, gross weight	r 593,482	706,649	749,834	788,526	986,290
Metal, primary only	56,667	68,988	88,282	96,223	120,100
Antimony: Metal (regulus)	840	r 860	r 882	921	821
Beryllium: Beryl, gross weight	NA	[2] 1,815	[2] 1,330	[2] 1,300	• 1,300
Cadmium: Metal	------	------	------	------	41
Chromium: Chromite, gross weight	34,969	59,685	r 77,694	109,535	205,659
Copper:					
Mine output, metal content	10,481	10,118	10,300	8,600	NA
Metal, refined, primary only	r 9,475	9,360	r 9,362	8,904	9,286
Gold, smelter troy ounces	148,504	130,628	120,244	101,628	115,357
Iron and steel:					
Iron ore and concentrate thousand tons	r 21,376	r 23,830	26,336	26,157	27,433
Pig iron, excluding blast furnace ferroalloys do.	6,593	6,952	7,082	6,911	• 7,151
Ferroalloys:					
Ferrochrome	324	------	629	------	171,000
Ferromanganese	125,735	149,331	137,482	131,192	
Ferrosilicon	17,522	20,539	19,394	20,000	
Steel ingots and castings thousand tons	6,086	6,470	6,087	6,433	• 6,412
Steel semimanufactures:					
Angles, shapes, sections do.	814	775	796	821	919
Bars and rods do.	1,495	1,588	1,744	1,581	1,435
Plates and sheets:					
Uncoated do.	680	779	737	665	664
Galvanized do.	148	125	49	49	167
Tinplate do.	106	90	80	78	91
Hoop, strip, skelp do.	334	426	432	375	490
Rails and accessories do.	566	544	476	489	530
Wire do.	99	113	106	104	159
Special steels, form not specified do.	------	------	------	------	33
Total do.	4,242	4,435	4,420	4,162	4,488
Lead:					
Mine output, metal content	4,505	3,981	3,734	2,366	2,550
Metal, primary only	3,624	r 2,384	2,543	2,474	1,369
Manganese: Ore and concentrate thousand tons	r 1,407	r 1,647	1,678	1,599	1,602
Rare-earth metals: Monazite concentrates, gross weight	2,093	• 2,540	• 2,600	NA	NA
Silver, smelter thousand troy ounces	152	168	89	112	81

See footnotes at end of table.

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Table 1.—India: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS—Continued					
Titanium:					
Ilmenite concentrate, gross weight	12,041	30,062	30,168	41,585	58,725
Rutile concentrate, gross weight	1,871	1,317	1,740	2,538	2,686
Tungsten, mine output, metal concentrate	4	7	13	15	20
Zinc:					
Mine output, metal content	5,915	5,317	4,886	5,269	6,968
Metal	-------	-------	-------	3,039	20,699
NONMETALS					
Asbestos	r 3,375	4,775	6,936	7,014	9,065
Abrasives, natural, n.e.s.:					
Garnet	r 295	r 222	172	283	1,988
Barite	r 47,205	48,283	51,663	51,707	51,718
Bromine, elemental	144	192	156	NA	NA
Cement, hydraulic thousand tons	9,690	10,578	r 12,490	11,700	11,940
Chalk	NA	NA	NA	NA	48,915
Clays:					
Ball clay	9,597	8,122	6,801	7,732	8,358
Bentonite	• 26,000	NA	NA	NA	NA
Fire clay	r 426,364	448,296	449,764	397,663	418,706
Fuller's earth	18,414	NA	NA	NA	NA
Kaolin (China clay) [2]	449,585	511,919	554,574	513,000	505,961
Corundum, natural	540	r 306	385	306	326
Diamond:					
Gem	• 1,920	3,829	1,812	• 5,442	7,280
Industrial	• 340	637	301	• 960	1,484
Total	2,260	4,466	2,113	6,402	8,764
Feldspar	24,382	24,771	26,004	27,528	33,493
Fertilizer materials:					
Crude: Phosphatic apatite	4,049	7,076	16,275	11,554	6,695
Manufactured:					
Nitrogenous, nitrogen content [4]	225,780	240,000	255,756	328,812	NA
Phosphatic, P_2O_5 content [5]	127,032	126,180	136,968	181,812	NA
Fluorspar, all grades	389	551	1,069	1,613	1,184
Gem stones, excluding diamond:					
Agate (including chalcedony pebbles)	NA	423	483	452	630
Emerald:					
Crude thousand carats	53	65	54	38	23
Dressed	80	80	NA	NA	79
Garnet kilograms	2,554	3,093	4,466	6,068	4,986
Sapphire do	197	225	185	189	NA
Gypsum thousand tons	882	1,160	1,293	1,028	1,321
Kyanite and related materials:					
Kyanite	r 34,163	37,481	63,670	49,549	64,361
Sillimanite	12,362	11,276	10,286	5,795	4,651
Lime	NA	NA	NA	NA	283,984
Magnesite	207,986	238,905	231,923	245,750	253,073
Mica:					
Crude	22,806	23,800	22,052	17,017	17,667
Processed: [6]					
Blocks	1,934	1,442	1,661	1,611	1,731
Splittings	8,790	9,426	6,413	5,522	6,001
Condenser film	90	80	96	92	86
Other	19,077	26,583	24,807	14,040	13,369
Pigments, natural mineral: Ocher	r 33,307	36,587	30,908	36,042	35,494
Quartz and silica thousand tons	r 248	297	276	259	294
Salt, all types do	4,647	r 4,719	r 4,522	4,488	5,044
Stone, sand and gravel:					
Calcite	r 13,906	20,481	17,751	16,063	13,292
Dolomite thousand tons	r 521	976	1,047	1,144	1,259
Limestone do	r 17,017	19,934	19,609	19,390	20,745
Slate	NA	1,408	1,060	1,804	859
Sand, calcareous thousand tons	NA	NA	NA	NA	822
Talc and related materials:					
Pyrophyllite	6,071	10,707	8,294	4,934	10,286
Steatite (soapstone)	r 139,891	r 157,065	147,932	130,195	165,826
Vermiculite	429	732	500	317	2,348
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	9,520	14,470	• 20,000	• 25,000	• 25,000
Coal:					
Bituminous thousand tons	62,440	r 67,162	r 67,974	68,206	69,280
Lignite do	1,569	2,300	2,568	2,930	4,126

See footnotes at end of table.

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Table 1.—India: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
MINERAL FUELS AND RELATED MATERIALS—Continued					
Coke:					
Coke oven and beehive—thousand tons	7,318	7,976	8,160	7,590	•8,000
Gashouse—do	69	64	65	•72	•72
Other soft—do	2,207	2,611	2,880	•3,000	•3,000
Total—do	9,594	10,651	11,105	•10,662	•11,072
Gas, natural—million cubic feet [7]	•5,000	•5,300	[r] 14,126	16,439	21,347
Petroleum:					
Crude oil—thousand 42-gallon barrels	16,965	22,494	[r] 35,624	42,190	48,552
Refinery products:					
Gasoline and naphtha—do	12,689	13,307	[r] 12,185	21,514	20,129
Kerosine and jet fuel—do	12,993	12,491	[r] 14,223	19,836	23,740
Distillate fuel oil—do	15,148	18,097	[r] 24,409	29,683	32,008
Residual fuel oil—do	15,183	15,990	[r] 19,488	24,409	20,746
Lubricants—do	286	292	[r] 403	448	([8])
Other—do	7,537	8,525	[r] 14,849	4,581	14,507
Refinery fuel including losses—do	1,710	2,802	[r] 4,620	6,861	7,985
Total—do	65,546	71,504	[r] 90,177	106,782	119,110

• Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, India also produces other varieties of gemstones (aquamarine, ruby and spinel) and natural graphite, but production data are not available.

[2] Actual production not reported owing to Indian Government security regulations; data presented are exports to United States as reported by India's Atomic Energy Department.

[3] Data given are total crude production; includes directly salable crude as follows, in tons: 1964—140,139; 1965—204,578; 1966—286,785; 1967—182,000; 1968—156,001. Balance of output in each year is classified in sources as "nonsalable crude"; material which requires beneficiation prior to sale. Processing of nonsalable crude resulted in the production of the following quantities of processed china clay in tons: 1964—87,921; 1965;—93,086; 1966—89,638; 1967—98,000; 1968—102,123.

[4] Includes nitrogen content of nitrogen-phosphate fertilizers.

[5] Includes phosphorus content of nitrogen-phosphate fertilizers.

[6] Actual production data not available; figures given are exports, but are believed to closely approximate actual production in most years.

[7] Converted from cubic meters at the rate of 1 cubic meter equals 35.3145 cubic feet.

[8] Included with other.

TRADE

Complete data on India's foreign trade for calendar 1968 were not available in time for inclusion in this report, but partial figures indicate that the value of mineral commodity exports increased significantly over those of 1967, while the value of mineral commodity imports apparently declined. Thus, at least among mineral commodities, there was an improvement in the trade balance, although it remained unfavorable. The following tabulation presents the approximate value of trade in mineral commodities and of total commodity trade for recent calendar years (adjusted from the Indian trade year—April 1 to March 31):

	Value (million U.S. dollars) [1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	229	1,682
1966	249	1,576
1967	[2] 291	1,600
1968	•385	1,750
Imports:		
1965	654	2,813
1966	507	2,698
1967	[2] 634	2,765
1968	•515	NA

• Estimate. NA Not available.

[1] Sources: 1965 and 1966; Statistical Office of the United Nations; 1967: Official foreign trade returns of the Government of India; 1968: U.S. Bureau of Mines estimates based on partial data obtained from Government of India by U.S. Embassy, New Delhi, except for 1968 total commodity trade which is a reported figure.

[2] Data not exactly comparable to those for 1965 and 1966 owing to slight differences in list of commodities included.

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While the tabulation is regarded as accurate enough to give a general portrayal of the role of mineral commodities in India's total trade, and, in addition, to reflect the general trend of the quantity of trade over the time-span shown, it should be noted that in addition to the comparability problem indicated in the footnote to the table, the devaluation of the Indian rupee from Rs 1=US $0.21 to Rs 1=US $0.133 on May 30, 1966, presented an additional problem in compilation of data. Moreover, the estimates for 1968 mineral commodity trade value were based upon commodities which accounted for only 60 percent of total mineral commodity imports and 90 percent of total mineral commodity exports in 1967; thus, depending on the differences between the trade pattern for these selected commodities and those for which 1968 data were not available, a considerable difference may be expected between these estimates and actual figures when they become available.

Among mineral commodity exports, iron ore, with a value of over $116 million in 1968, was clearly the dominant single commodity, and probably again accounted for about one-third of the total for this group as it did in 1967. Other major export mineral commodities were iron and steel, gem stones (including diamond), mica, and manganese ore. Dominant classes of mineral commodity imports were iron and steel, nonferrous metals, and petroleum (crude and refined).

Definitive data on India's principal trading partners in total mineral commodities were not available for 1967 or 1968, but Japan, the recipient of most of the iron ore and appreciable quantities of other mineral raw materials, undoubtedly remained the foremost destination for exports, probably accounting for 40 percent or more of the total as it did in 1966. Other major recipients of exports, in order of rank in 1966, were the United States, the United Kingdom, Belgium-Luxembourg, Nepal, and Czechoslovakia. In the case of imports, leading sources in 1966 were the United States, Iran, West Germany, the United Kingdom, and Japan.

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Table 2.—India: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 p
METALS		
Aluminum:		
Bauxite	53,523	98,916
Metal, including alloys, all forms	1,480	[1] 17,055
Chromite	77,211	108,822
Copper, metal including alloys, all forms	229	[1] 1,871
Iron and steel:		
Iron ore and concentrate thousand tons	13,562	15,646
Pig iron and sponge iron do	450	739
Ferroalloys:		
Ferromanganese	24,525	73,320
Ferrosilicon	1,910	3,161
Other	------	2,700
Iron and steel scrap thousand tons	1,057	801
Steel ingots and semimanufacturers thousand tons		508
Lead, including alloys, all forms	6	[1] 3
Manganese ore and concentrate thousand tons	1,108	1,195
Silver metal, all forms thousand troy ounces	369	1,748
Tin, including alloys, all forms	16	[1] 149
Titanium, ore and concentrate (ilmenite)	23,519	48,525
Zinc, including alloys, all forms	319	[1] 21
Other: Nonferrous metal scrap, not further identified	(2)	4,412
NONMETALS		
Abrasives, natural, tripoli earth and emery	------	387
Asbestos	70	22
Barite	6,607	2,864
Bentonite	407	973
Boron materials (borax)	60	------
Cement	31,822	172,827
Chalk	6	28
NONMETALS—Continued		
Clays:		
Fire clay	61	102
Fuller's earth	453	8
Kaolin	643	86
Other	438	135
Diatomaceous earth (Kieselguhr)	------	89
Feldspar	7,989	8,530
Graphite	14	160
Gypsum	1,000	950
Kyanite and related materials:		
Kyanite	40,436	50,464
Sillimanite	2,046	2,513
Lime	574	457
Magnesite	19,916	21,920
Mica, all grades	21,265	21,187
Mineral pigments:		
Red oxide	172	------
Other	242	621
Salt thousand tons	237	298
Stone, sand and gravel:		
Limestone	1,129	408
Marble	3	70
Building stone, not further identified	11,686	4,750
Gravel	2	2
Sand, including natural quartz	3,388	3,052
Talc and related materials, steatite	9,629	9,734
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen	1,467	48
Coal and coke thousand tons	242	498
Petroleum refinery products:		
Gasoline and naphtha thousand 42-gallon barrels	7,599	4,601
Distillate fuel oil do	1,157	179
Residual fuel oil do	413	159
Petroleum coke do	211	75
Asphalt do	------	27
Unspecificed do	40	------
Total do	9,420	5,041

p Preliminary.
[1] Excludes scrap, if any, which is given subsequently as part of an aggregate of nonferrous metal scrap.
[2] Apparently reported under specific metals.

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Table 3.—India: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968 p
METALS		
Aluminum metal, all forms	48,379	13,298
Antimony:		
Ore and concentrate	1,527	1,731
Metal, all forms	5	2
Arsenic sulfides	9	9
Chromite	5	------
Copper metal and alloys, all forms	46,161	35,914
Iron and steel:		
Pig iron, sponge iron and powder	------	273
Ferroalloys:		
Ferrochromium	842	707
Ferromanganese	257	128
Ferromolybdenum	102	426
Ferrophosphorus	244	377
Ferrosilicon	77	68
Ferrotungsten	24	34
Other	480	483
Total	2,026	2,223
Steel ingots and semimanufactures	505,539	418,827
Lead:		
Ore and concentrate	23	7
Metal including alloys, all forms	41,143	35,219
Manganese ore	5,898	7,263
Nickel:		
Ore and concentrate	22	14
Metal and alloys, all forms	1,939	1,811
Platinum metal, troy ounces	4,887	2,283
Silver metal, do	9,710	1,897
Tin metal and alloys, all forms long tons	4,230	4,095
Titanium ore	651	29
Tungsten ore concentrate	204	207
Zinc:		
Ore and concentrate	20,501	19,408
Metal, including alloys, all forms	71,442	104,990
NONMETALS		
Abrasives, natural	1,985	68
Asbestos	29,483	26,670
Bentonite	7	11
Boron materials (borax)	2,776	4,067
Chalk	658	217
Clays:		
Ball clay	4,574	2,857
Fire clay	41	6
NONMETALS—Continued		
Clays—Continued		
Fuller's earth	70	24
Kaolin	3,772	2,105
Other	302	167
Diamond:		
Gem, value, thousands	$1,830	$21,694
Industrial, thousand carats	660	150
Diatomaceous earth	1,378	1,118
Fertilizer materials, crude:		
Nitrogenous sodium nitrate	9,300	2,343
Phosphate rock thousand tons	603	861
Potassium salts	------	7
Fluorspar and cryolite:		
Cryolite	1,182	392
Fluorspar	7,783	4,293
Graphite	1,237	972
Gypsum and plaster	3	2
Lime	27	------
Magnesite	109	23
Mineral pigments:		
Red oxide	2,423	------
Other	144	78
Stone, sand and gravel:		
Marble	7	3
Alabaster	45	43
Building stone, not further specified	35	2
Gravel	193	120
Sand, all types	499	485
Sulfur	592,668	389,447
Talc and related materials, steatite	2	------
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	2,616	469
Coal, anthracite	1,045	241
Coke	113	601
Petroleum:		
Crude oil thousand 42-gallon barrels	65,198	77,933
Refinery products:		
Aviation gasoline, do	351	262
Kerosene and jet fuel thousand 42-gallon barrels	3,519	4,080
Residual fuel oil, do	367	191
Lubricants, do	2,804	2,800
Total, do	7,041	7,333

p Preliminary.

COMMODITY REVIEW

METALS

Aluminum.—India, with a 1968 bauxite output of just under 1 million tons, ranked 12th among world producers. About two-thirds of total output was consumed indigenously in the producion of alumina for the domestic aluminum industry, about a fifth was used by India's chemical, refractory, cement, steel, oil refining, and abrasive producers, and the rest was exported. Aluminum output at 120,000 tons, was only about 1.4 percent of total world production, and was roughly adequate to meet India's 1968 requirements.

Bauxite.—In response to increases in domestic demand and increasing foreign markets, India's bauxite mining operations increased output by nearly 19 percent in 1968. Growth of the domestic market has been the principal factor in expanded output. Mining continued to be wholly by open pit methods, but hand shovel mining and head basket transport, formerly used and permitting a high degree of selectivity, have given way to partly and wholly mechanized production techniques. At year-end, Hindustan Aluminium Corp. Ltd. had two fully mechanized mines (one at Baoli, the other at Ranchi), Indian Aluminium Co.'s Lohardaga area property was nearly

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fully mechanized, Madras Aluminium Co. was in the process of modernizng its Shevaroy Hills operation, and Aluminium Corporation of India had plans to at least partly mechanize its mines in the Ranchi area.

Future expansion also seemed more likely to be related to domestic industry growth rather than to the export market, not only because of obvious economic advantages to be obtained from marketing alumina or aluminum rather than bauxite, but also because of the high cost of transport from inland mines as well as the inadequacy of port facilities. A partial exception to this rule, however, was noted in the case of recently discovered deposits in Goa, which, when placed in operation in early 1969, should contribute to further export market growth. These deposits, controlled by the Goan firm, Khushaldas & Brothers, are to be expanded together with necessary port expansion, to permit shipments up to 200,000 tons annually by 1974. In contrast, a Japanese survey of Gujarat State ports reportedly was unfavorable for expansion of purchases from this area.

National bauxite reserves total 275 million to 300 million tons, including 73 million tons containing over 50 percent Al_2O_3. Recent additions include about 10 million tons in Allahabad and Banda Districts of Uttar Pradesh and a similar quantity in Goa.

Alumina.—In addition to the required alumina facilities to meet demands of the growing domestic aluminum industry, the Central Government has authorized Gujarat Mineral Development Corp. (owned by the Gujarat State Government), to establish a 100,000 ton-per-year export oriented alumina plant, probably in the Kutch District. The facility has a target onstream date in 1973, by which time a 480-megawatt thermal power station at Ukai is slated to be operational, and from which necessary power is expected to be obtained.

Aluminum Ingots.—With a 1968 output of 120,100 tons, India's aluminum smelters operated at 102.6 percent of nominal rated capacity in 1968. Output was derived from four plants, all in the private sector. These plants, together with new plants underway or planned for completion by 1973 are listed in table 4, together with present capacity and planned capacity.

The planned expansion reflected in table 4 was based on the assumption that demand for aluminum in India would reach 300,000 tons by 1970. Under the same assumption, domestic demand for 1968 had been forecast at 220,000 tons, but in reality the figure was only about 105,000 tons. Original figures were based in part on presumed success of a Government aluminum for copper substitution program, which met with consumer resistance, as well as upon a greater industrial growth rate than has actually materialized. More recent estimates by Indian authorities indicate that demand may not exceed 250,000 tons by 1973. Thus, barring cancellation of some of the plans for the 216,300-ton increase in total capacity planned, or an unexpected upturn in the national economy, producers will be forced to seek export markets or to curtail output below capacity levels to avoid overproduction. Therefore, it appears possible to Indian observers that some existing expansion plans may be cut back.

Chromite.—India's chromite production increased 88 percent in 1968, apparently owing to improved world market conditions for the Indian product, which in turn was attributed to the restrictions on

Table 4.—India: Aluminum ingot plants and capacities

Company	Plant location	Capacity (thousand metric tons)	
		1968 rated	1973 proposed
Aluminium Corp. of India Ltd	Asansol	8.7	12.5
Bharat Aluminium Co. Ltd	Koyna	------	50.0
Do	Korba	------	100.0
Hindustan Aluminium Corp. Ltd	Renukoot	60.0	80.0
Indian Aluminium Co. Ltd	Hirakudand Alwaye	35.8	35.8
Do	Belgaum	------	[1] 30.0
Madras Aluminium Co. Ltd	Mettur	12.5	25.0

[1] Plant due on stream in 1969.

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Rhodesian chromite movements imposed by the United Nations. National reserves have not been estimated in recent years, but a figure of 4.9 million tons of minable ore is regarded as conservative. Of this figure, nearly 60 percent is in Orissa State and is largely of metallurgical and chemical grades.

Of the total export of 108,822 tons in 1968, 103,577 tons went to Japan, including 72,706 tons of 48–56 percent Cr_2O_3 and 26,796 tons of 38–48 percent Cr_2O_3; other recipients were Australia 5,001 tons and Thailand 244 tons (below 38 percent Cr_2O_3).

Copper.—Through 1968, India's domestic copper industry continued to play only a small role in providing the country's requirements for this metal. Smelter output, which was essentially equal to mine production, constituted less than 10 percent of the estimated 1968 metal demand of 104,000 tons, and despite sizable recent additions to reserves, industrial development plans call for expansion to only 47,500 tons capacity by 1973–74. By that time, demand is expected to reach 124,000 tons per year.

In 1968, one firm, the private sector Indian Copper Corp., accounted for the entire production, and this firm apparently will continue as the sole producer until the public sector 31,000-ton-per-year Hindustan Copper Ltd. Khetri-Kolihan project comes into production in 1973. Indian Copper Corp. at yearend had plans for expansion and modernization calling for replacement of its outdated 9,960-ton-per-year smelter with a 16,500-ton-per-year flash smelter by 1971. Work on the Khetri project progressed slowly in 1968, and there was some doubt expressed that the project would be in operation by the target date of 1973. Other copper properties remained under varying degrees of consideration for development by the Central Government and various State agencies in 1968, but there was no substantive progress toward exploitation.

A recently revised appraisal of India's more important copper deposits gives a total figure of 2,835,000 tons of contained copper in 11 deposits with ore grades of 0.6 to 2.4 percent. This figure includes proved reserves of 767,000 tons; indicated, 1,554,000 tons; and inferred, 514,000 tons. The Rakha deposit of the Singhbhum ore belt in Bihar State contains over 1.1 million tons of copper in ore grading 1.3 percent copper, while the Madhan Kudhan deposit of the Khetri belt of Rajasthan State contains 520,000 tons of copper in ore containing 1.0 percent copper. Other more notable ore bodies include the Mosabani deposit in the Singhbhum belt of Bihar, with 670,000 tons of contained copper in 2.0-percent ore and the Kolihan deposit of the Khetri belt with 295,000 tons of contained copper in 2.4-percent ore. It should be noted that the 2.8-million-ton-plus national reserve estimate does not include lesser deposits now known, nor does it make any allowance for possible new additions that may be made from detailed study of "Operation Hardrock" results.

Gold.—Although gold production registered a substantial increase in 1968 over the 1967 level, it remained significantly below levels reported for 1964–66, and the outlook was for diminishing production. The nation's two producers, the Kolar group and the Hutti mine, both continued to operate through 1968, and reported reserves totaling 3.8 million metric tons of ore averaging 8.5 grams (0.27 troy ounce) of gold per ton, but operating costs exceeded the product value, as has been the case for several years.

With a view to minimizing losses, if not attaining outright profitmaking operation, a government-appointed working group of the Committee on Science and Technology investigated the Kolar goldfields and recommended replacement of obsolete equipment with new imported equipment, as well as immediate starts on research and development programs aimed at improving mining and milling methods, a more aggresive ore development program and certain organizational changes.

Iron Ore.—The 4.9 percent growth in Indian iron ore output in 1968 reflected further expansion of the export market, chiefly to Japan, rather than increased domestic consumption. In fact, reported estimates of 1968 iron ore use by the nation's iron and steel industry indicate a 3 percent decline with respect to the 1967 consumption level of 12.14 million metric tons.

The increase in iron ore output and export has been achieved despite the increasingly competitive nature of the

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world market. This increasing competition, coupled with higher transport costs to European markets owing to the closure of the Suez Canal, has driven the price of Indian iron ore for export generally downward in recent years (with some improvement in 1968 over 1967 levels), as shown in the following tabulation:

Year	Average f.o.b. price (all Indian ports, exported iron ore.) (dollars per metric ton)	
	To Japan	To all countries
1964	7.46	7.44
1965	7.06	7.32
1966	6.82	7.05
1967	6.95	6.23
1968	7.16	7.45

Exports are shown by destination in table 5.

Table 5.—India: Exports of iron ore

(Million metric tons)

Country	1967	1968
Belgium	.25	.37
Czechoslovakia	.98	.98
Germany:		
East	.19	.02
West	.19	.30
Hungary	.13	.16
Japan	11.02	12.51
Poland	.20	.22
Rumania	.37	.75
Yugoslavia	.11	.24
Other	.11	.10
Total	13.55	15.65

In response to market pressures, and in an effort to maximize profits, Indian producers have shown increasing interest in pelletization, which not only will provide an improved product, but will also utilize ore fines, now rejected, and contribute to overall greater recovery from mine run ore. Through 1968, only one firm, the export-oriented Chowgule & Company, Pale, which operates in Goa, had a pelletizing plant (500,000 tons per year). However, this firm plans to erect a second facility, with a 2-million-ton capacity, in the near future, and other mining operations were considering such installations. These included Kemmannugundi-Kudremukh in Chikmagalur District (under development in1968); Kiriburu in Keonjhar District of Orissa, and Bailadila in Bastar District of Madhya Pradesh, among others.

Under the revised fourth 5-year plan (April 1, 1969–March 31, 1974), the Planning Group on Iron Ore envisages a total iron ore production of 54 million tons by the end of the plan period (nearly double the 1968 rate), including 31 million tons for export, over 75 percent of which is expected to go to Japan. To achieve this output level, an investment of about $319 million (Rs 2,400 million) is suggested by the Planning Group, including about $40 million in private sector investment to allow for a 9-million-ton-per-year increase. Recommended distribution of the total $319 million by projects, including necessary railways and ports, but not by sector is as follows: Bailadila mines—$124 million, Barajamda—$24 million, Daitari-Paradip—$26 million, Bellary-Madras—$78 million, Goa—$63 million, miscellaneous—$4 million.

National reserves are more than adequate to support the planned expansion; they are estimated at about 21,300 million metric tons, including 6,400 million tons measured and indicated and 14,900 million tons inferred.

Major iron ore development projects underway or contemplated include a number by the public sector National Mineral Development Corporation (NMDC). Notably, the Kiriburu mine, NMDC's first venture, which in 1968 produced at a 2-million-ton-per-year rate, is to be expanded to 5 million tons per year; and the Bailadilla operation, also a 2-million-ton operation in 1968, is to reach 5.5 million tons of run-of-mine ore and 4 million tons of sized salable product. In Mysore, NMDC expects its Donimalai project to have a 5-million-ton annual capacity for run-of-mine ore (2.5 million tons of lump ore and 2.5 million tons of salable fines) by 1971–72, and by the same time, it plans to have the first phase of its Kudremukh facility in operation, producing 4 million tons of sinter feed. The latter facility is tentatively slated to begin pellet production in 1974–75 at a 2-million-ton annual rate and to raise this to 4 million tons by 1978. Elsewhere, the Orissa State government's Orissa Mining Corp. expects that its 4-million-ton-per-year operation (2.5 million tons of seized ore, 1.5 million tons of fines) at Daitari will start operations in June 1969 with operation at capacity to begin in October. The Tamil Nadu State government, using its own resources, intends to

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establish a pelletizing plant to process Salem District iron ores to provide feedstock for a State-owned steel plant which also is to be built without Central Government funds, inasmuch as the plant was not included in the fourth 5-year plan.

Iron and Steel.—India's iron and steel production in 1968 did not reach levels targeted by national economic planners, as expected demand did not fully materialize, but overall there was slight improvement over 1967 results. Perhaps more significantly, there was a general upturn toward yearend in response to apparent improvement in market conditions. Steel ingot output stood close to par with 1967 levels, but as a result of increases in capacity, differed from total national capacity by a greater margin than in 1967. Nominal ingot capacity of the five integrated plants stood at about 8.9 million tons, distributed as follows in million tons: Tata Iron and Steel Co. (TISCO)—2.0, Indian Iron and Steel Co. (IISCO)—1.0, and Hindustan Steel Ltd. (HSL)—5.9. (The latter figure is for three plants as follows: Rourkela—1.8, Bhilai—2.5, and Durgapur—1.6).

Iron and steel trade for the first time in recent years was favorably balanced. Exports were valued at $112.5 million compared with imports valued at $110.2 million. (Comparable 1967 figures were $81.5 million and $153.4 million, respectively.) Both the upturn in exports and drop in imports were attributed to a slowdown, below planned levels, in the economy as a whole, with an attendant drop in steel consumption.

Of the total export, HSL's plants provided almost three-fifths, TISCO and IISCO one-fifth, and the rerolling industry about one-fifth.

Internal demand for iron and steel apparently totaled over 6 million tons in 1968. While overall availability was improved over that during past years, the supply of already scarce flat products worsened as the economy recovered from the recession. Billets, foundry pig iron, skelp, and strip also were in short supply at times although toward yearend the skelp and strip situation was eased as production from the new (July 1968) Durgapur skelp mill became available. The pig iron shortage was attributed to an upsurge in exports of this material, while the billet shortage was credited to the integrated plant producer's preference for rolling more billets to rods and bars for export, as opposed to selling billets to Indian rerollers who compete with the integrated plants in the export market.

In an effort to reduce idle capacity, attempts were made by major producers to adjust rolling mill product output to changes in market demand. IISCO and the Bhilai and Durgapur plants of HSL have developed new steel sections (mainly for joists and rounds) in response to domestic and export demand, while the Rourkela plant has commenced production of electrolytic tinplate and electrical steel sheet. TISCO and IISCO have begun production of twisted ribbed steel bars for concrete reinforcement from low-carbon steel, which producers claim can replace plain round bars with a 40-percent savings in weight. Bhilai and Durgapur are also slated to begin production of this new product, under the IISCO trade name of "Torsteel." (TISCO styles its twisted bars "Tistrong.").

With regard to plant expansion, TISCO and IISCO plan modest growth through modification and relatively minor additions, with target ingot capacities of 2.2 million tons and 1.3 million tons, respectively. The Rourkela plant has a proposal for expansion to 3.4 million tons, but a 400,000-ton addition is all that is expected in the near future. The Bhilai plant has underway a 700,000-ton expansion in pig iron capacity due onstream in 1970, with more ingot facilities and rolling mills slated for addition later. The Durgapur plant, beset with technical, managerial, and labor force problems, has no expansion plans and none are expected.

India's fourth major public sector steel venture, the Bokaro plant, was running 9 months behind the most recent revised schedule and may not be commissioned until 1973. This facility, which is to have a 1.7-million-ton ingot capacity, has suffered from almost continuous disputes between the numerous contractors and their employees as well as from delays in receiving Soviet-supplied plans, other delays in receipt of Heavy Engineering Corporation-supplied equipment and from delivery of defective refractories by Indian contractors.

Lead and Zinc.—Although over 100 lead-zinc deposits are known in India, some of

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which show at least some potential for economic operation, only one mine was in production in 1968. Moreover, despite significant foreign exchange expenditures for imports of these metals ($8.9 million for lead and $28.4 million for zinc in 1968), Government economic planners had no recommendations for near future detailed study or development of additional deposits. Thus, for these commodities, the Central Government apparently seemed willing to accept continued foreign dependence for the near future.

The single operating mine, the Zawar property of the public sector firm, Hindustan Zinc, Ltd., produced 191,629 tons of mine run ore in 1968 (165,650 tons in 1967), which, upon beneficiation, yielded 3,566 tons of lead concentrates and 12,839 tons of zinc concentrates (3,995 tons and 10,029 tons respectively in 1967).

Proved reserves at Zawar are estimated at 8 million tons with probable reserves set at 21 million tons. Ore grade, officially reported at 3.7 percent zinc and 1.8 percent lead, is believed to be somewhat lower than this, particularly in the case of lead. The mill capacity of 500 tons daily in late 1967, reportedly was in the process of being increased to about 2,000 tons daily by year-end 1971.

The most notable 1968 development in India's lead and zinc industry was the commencement of production-scale operation at two zinc smelters that officially had been commissioned in 1967. The 18,000 ton-per-year Debari smelter of Hindustan Zinc, Ltd., near Udaipur in Rajasthan operated at full capacity from January to June, suspended production during July and August, and thereafter operated at about 70 percent of capacity through year-end. This smelter operated solely on ore from the Zawar mine. The July-August shutdown was occasioned by the development of excessive stocks of superphosphate fertilizers (a byproduct), while the restricted output for the final 4 months of 1968 was due to unexpected zinc metal surpluses. The latter were developed despite the fact that India's other new zinc smelter, the imported concentrate-based Edayar plant of Cominco Binani Zinc, Ltd., near Alwaye, Kerala State, operated at less than half of its 20,000-ton rated capacity. This shortfall was attributed to a continuation of technical difficulties that restricted output to 3,000 tons during May–December 1967.

Lead production, entirely from the Tundoo lead smelter of Hindustan Zinc, Ltd. near Dhanbad, again declined, as the lead content of ore from the Zawar mine continued to fall off.

Lead imports declined 14 percent in 1968 to 35,219 tons, but this decline, even coupled with the production drop, did not seem to have any severe impact on markets. A sizable increase in the demand level (from about 45,000 tons to 57,000 tons) has been forecast for 1969, but it remains to be seen if such a sharp increase will occur.

Zinc metal imports increased 47 percent in 1968 to 104,990 tons, contributing to the temporary oversupply that occurred as annual consumer demand fell unexpectedly to about 80,000 tons. A demand for 90,000 to 100,000 tons was originally anticipated. Domestically produced metal, priced at $427 per metric ton, could not compete with imports at $415 per ton. While import controls were expected in 1969 in an effort to improve the domestic zinc price situation, the long-run prospect of continued import of sizable quantities of zinc in some form led to revival of a 1966 proposal to erect another imported concentrate-based smelter. The original engineering study was undertaken by a Polish agency, but the study was suspended in late 1966. The same group was asked to complete this study basing the revised study on maximum use of Indian skills and equipment. The plant would be located at the port of Visakhapatnam, on India's east coast.

Manganese Ore.—Although manganese ore output and exports edged upward slightly in 1968, the output gain was far less proportionally than that attained for other commodities and the total value of 1968 exports was less than that of 1967 shipments owing to lower unit prices as well as to shipment of relatively greater quantities of lower grades and lesser quantities of higher grades. This shift is indicated in table 6, which shows the distribution of total manganese ore exports both by grade and by destination. Regarding the distribution by destinations, it is significant to note that Japan took a sizably larger share in 1968 than in 1967, account-

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Table 6.—India: Exports of manganese ore by type and destination

(Thousand metric tons)

Type and destination	1967	1968
Types:		
Ore, 48 percent manganese or greater	226	161
Ore, 35–48 percent manganese	359	805
Ore, ferruginous, below 35 percent manganese	521	728
Peroxide and other processed oxides	2	1
Total, ores and similar materials	1,108	1,195
Destinations (all types):		
Japan	649	764
Czechoslovakia	96	103
United States	168	87
United Kingdom	73	69
Belgium	37	60
Netherlands	22	29
France	-----	26
Germany, West	52	22
Other	11	35
Total	1,108	1,195

ing not only for the entire increase but also for a share of the market taken in 1967 by other countries.

Through 1968, manganese ore exports continued to be controlled rigidly by the Indian Government. The Government-owned Minerals and Metals Trading Corporation (MMTC) purchased all ore destined for export (over 75 percent of total production in 1968) except that produced by Manganese Ore (India) Ltd., a government firm itself. MMTC pays a rupee price for the ore and then disposes of it on the world market, basing its decision as to whether to barter or sell the ore on the impact on India's overall foreign exchange situation.

Reliable substantive data on India's manganese ore reserves are not available, although they are known to be large. Many producers have little idea of the actual quantity of recoverable ore on their holdings, and lack funds, equipment, and/or incentive to properly develop their reserves. Of an estimated total national reserve of 180 million tons, less than 20 percent is classified as proved and indicated. (7.68 million tons proved, 24.75 million tons indicated). The Planning Commission of India, recognizing the need for better data in order to permit realistic planning for the soundest development of this resource, has called for efforts to prove a minimum of 49 million tons of ore and has recommended expenditures equivalent to $8 million for such a project.

NONMETALS

Cement.—India's cement output in 1968 was regarded as adequate to meet requirements for the first time in recent history. This attainment of self-sufficiency, however, to a significant extent was the result of reduced demand owing to a general countrywide economic slump, coupled with addition of new facilities, with an aggregate capacity of 1.56 million tons. In fact, because of the economic slump, output was held to the level required to meet domestic and export requirements and the full national 14.76 million ton (yearend 1968) capacity was not reached.

As a result of action taken in 1967, responsibility for distribution of cement in India was given to the Government-owned Cement Corporation of India Ltd. effective January 1, 1968. This action relieved the Cement Allocation and Coordination Organization (a producers' association) of this responsibility, and in addition provided for output and price controls. The need for the latter restrictions, however, was questioned, and by yearend it appeared that such controls would soon be removed.

Exports in 1968, although modest relative to total output, were over 5 times the 1967 level, totaling 172,827 tons, and The State Trading Corporation (STC), the nation's sole cement exporter, forecast a 300,000-ton level for 1969. Producers, however reportedly were not particularly enthusiastic at this prospect, preferring to sell their output on the domestic market, unless the export subsidy is raised. This subsidy, 25 percent of the f.o.b. price (provided by STC) plus an 80-cent-per-metric-ton added operating cost allowance (provided by the Cement Controller), was regarded as an inadequate incentive by producers, who argued that domestic prices were higher than the level of the export price plus the subsidy payments.

Mica.—India's mica industry retained its position as the world's dominant supplier of strategic grades of natural mica in 1968, although crude output advanced only marginally, in both quantity and value. Synthetic substitutes continued to make inroads into the overall world market. Total

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mica exports declined slightly on a tonnage basis as a result of a 13-percent decline in scrap mica shipments, although value of exports advanced somewhat owing to larger shipments of strategic grades. Table 7 details mica trade.

Under pressure from Indian fabricators of mica products, the Government reduced the export duty on processed mica powder from 40 percent ad valorem to 20 percent ad valorem effective July 1968. All other forms of mica except micanite (a material fabricated from fine ground and waste mica) remained subject to the 40-percent duty through yearend, but certain grades of loose splittings were slated for reduction to the 20-percent rate effective March 1, 1969. Indian producers continued to request a total exemption of duty on all exports except powder; through yearend, full exemption appeared unlikely, although reduction of all grades to the 20-percent rate appeared possible in 1969.

It appeared at yearend that the Mica Export Promotion Council (MEPC) might be terminated in 1969 due to financial troubles that have resulted in ineffective operation. Indications were that a new advisory committee would be established to replace MEPC.

Phosphate Rock.—Until 1966, it was generally believed that economically recoverable phosphate occurrences did not exist in India. However, USAID personnel did not share this view, and in April of that year, two widely separated occurrences were recognized and described—the Mussoorie occurrence in Uttar Pradesh and the Birmania occurrence in Rajasthan. The former area later received closer scrutiny under "Operation Softrock," a USAID assistance project, and fieldwork in this area continued through 1968. In 1967 the Geological Survey of India independently found what is reportedly the most important phosphate discovery examined to date. Occurrences examined through yearend totaled seven, all within 21 kilometers of Udaipur in south-central Rajasthan. Preliminary indicated reserve data for four of these occurrences total 76 million tons grading 20 to 36 percent P_2O_5. The remaining three occurrences have not been evaluated with regard to quantity of material available, but have considerably lower grades of ore (8–20 percent) on the basis of reports released thus far.

The larger and higher grade ore bodies are regarded as excellent for open-pit mining at a potentially low cost. Moreover, no ore treatment other than crushing and sizing is believed necessary, and transport to the currently (1968) operating single super phosphate plant of Hindustan Zinc, Ltd. at Debari involves haulage of 18 kilometers or less.

Plans were underway for mining of this deposit by the Rajasthan State government,

Table 7.—India: Mica exports by type and destination

(Metric tons)

Country	Block	Film	Splittings	Scrap or waste	Ground	Other [1]
1967: Total	1,611	92	5,522	12,588	1,354	98
1968:						
Czechoslovakia	26	2	461	927	--------	--------
France	24	2	277	2,008	--------	8
Germany:						
East	35	(2)	18	65	100	2
West	39	(2)	288	567	70	54
Hungary	23	--------	416	--------	476	(2)
Italy	41	(2)	170	126	29	(2)
Japan	682	8	766	1,700	--------	10
Norway	(2)	--------	--------	2,650	1,101	--------
Poland	51	(2)	302	50	176	(2)
U.S.S.R.	131	46	--------	--------	--------	(2)
United Kingdom	333	12	708	1,353	--------	17
United States	203	8	2,076	1,087	68	67
Other	193	8	519	411	224	28
Total	1,731	86	6,001	10,939	2,244	186

[1] Consists of mica processed for condenser film, condenser plates, cut sheets, cut strips, washers, and discs as well as built-up mica products.
[2] Less than ½ unit.

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with production slated to start about July 1, 1969, with an initial rate of 300,000 tons per year. Hindustan Zinc, Ltd., reportedly will accept 500 tons of rock daily as soon as mining commences, and the Trombay Fertilizer Plant near Bombay reportedly also agreed to take 500 tons daily. By way of comparison, phosphate rock imports in 1968 totaled 860,625 tons, valued at $16.7 million, a tonnage increase of 43 percent over the 1967 level. If mining plans reach fruition, an annual foreign exchange saving of about $5.8 million may be possible in the immediate future.

MINERAL FUELS

Coal.—Coal continued to rank as India's leading mineral commodity in terms of value, providing about 59 percent of the total value of crude mineral output in 1968. Coal production increased slightly to 69.3 million tons, but the industry remained in a precarious economic position for a fifth year, with a significant part of its capacity idle. As early as 1964, the coal producers were prepared to meet an annual demand for 97 million tons, but as a result of continuing lags in industrial development and cessation of exports to Pakistan, actual demand has never approached levels expected by the Planning Commission.

Of total 1968 output, private sector collieries produced 76.1 percent, the National Coal Development Corporation (NCDC) collieries provided 18.0 percent, and the Singareni Collieries Company (Andhra Pradesh State-Central Government owned) produced 5.9 percent. Of the 69.3-million-ton total, almost 24 percent was coking coal; open-pit mines provided 22.6 percent of all coal mined, while underground operations contributed 77.4 percent.

Of the 778 mines reporting coal production in 1968, only six produced over 600,000 tons each during the year, 49 produced between 300,000 and 600,000 tons each, and 168 produced between 120,000 and 300,000 tons each.

All public sector opencast mines are partially to fully mechanized, private-sector opencast mines remain largely manually operated. Some underground mines, such as those of NCDC, Singareni Collieries Co. Ltd. and Tata Iron and Steel, are partially mechanized, but hand mining, loading and tramming continue to dominate in most all other underground operations.

Coal consumption in India in 1968 was distributed as follows, in million tons: Railways—17, thermal power stations—15, iron and steel industry—14, other industries (including exports of about 500,000 tons)—19. Forecasts by the Planning Commission call for a consumption level of over 93 million tons by 1973 (including 620,000 tons for export). While producers apparently could attain such a level if necessary, the target is viewed as unrealistically high barring an unforeseen upward swing in the total national economy, and a figure of 80 million tons by 1973 is regarded as realistic.

Coal reserves have recently been reassessed by the Geological Survey of India and the Indian Bureau of Mines; total proved, indicated and inferred reserves are now stated to be approximately 120 billion tons, including 45 billion tons proved. Of the total recoverable coal, the Jharia field of Bihar and the Raniganj field of West Bengal together contain about 40 percent.

Lignite.—The Neyveli Lignite Corporation (public sector) Neyveli mine in Tamil Nadu continued as India's only significant lignite producer in 1968, increasing output 1.2 million tons to 4,120,000 tons. Only 6,000 tons was produced elsewhere. The mine is only one element of the Neyveli complex, which includes a 400-megawatt thermal powerplant, a 152,000-ton-per-year urea fertilizer plant, and a 380,000-ton-per-year briquetting and carbonization plant. Since commencement of powerplant operations (at a lower capacity) in 1964, this element has operated at a financial loss, but power sale rates were increased in 1968 to lessen this deficit. The urea plant operated at only about 51 percent of capacity in 1968, chiefly owing to technological problems that were to be rectified by 1970 as a result of modification that were started in 1968. The briquetting plant has also operated below capacity since inception of operations, but in this case, lack of market acceptance rather than technology has been the major problem. In 1968, some improvement in the situation was noted, and efforts were being made to develop an export market for this product in Southeast Asia.

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Petroleum.—Despite intensive exploration and development drilling that set a new 1-year record for the country, India's crude oil reserves at yearend totaled only 969 million barrels, a 6.4-percent decline from the yearend 1967 figure. All phases of oil industry activity were intensified during 1968, as reflected not only in the 48-percent increase in well completions, but in crude production (up 3.2 percent), refinery production (up 11.5 percent), and imports of both crude oil and refinery products (up 19.5 percent and 4.1 percent, respectively). Despite increases in output and imports and curtailment of exports, product supply continued to fall short of demand, at least in some areas for some products.

Exploration, Drilling, and Crude Production.—The following tabulation summarizes 1968 operations in India's oilfields, all located in the States of Assam and Gujarat, and compares performance with that of 1967:

	1967	1968
Drilling activity:		
Number of wells completed:		
Oil	35	58
Gas	3	4
Dry	13	29
Service	36	38
Total	87	129
Footage completed thousand feet	745	1,056
Number of wells drilling at yearend	21	37
Production:		
Number of wells producing at yearend:		
Flowing	372	448
Artificial left	433	437
Total	805	885
Crude oil produced thousand barrels	42,190	43,552
Reserves at yearend:		
Crude oil do	1,035,000	969,000
Natural gas million cubic feet	2,217	NA

NA Not available.

Source: World Oil. V. 169, No. 3, August 1969, p. 210, except for crude oil output and natural gas reserve data.

The Government's Oil and Natural Gas Commission (ONGC), the nation's only petroleum and natural gas exploration and development organization, exceeded projected drilling targets by about 4 percent, with 50 operating rigs. In addition Assam Oil Company operated one rig and Oil India Ltd. operated four rigs. Of total drilling activity indicated in the foregoing tabulation, ONGC drilled 124 wells (944,000 feet) in 1968 and 76 wells (656,000 feet) in 1967. Of the 124 wells drilled by ONGC, 43 were in Assam and 76 in Gujarat.

Although no major discoveries were reported during 1968, Oil India's Kusijair Well No. 2 at Dum Duma, upper Assam, reportedly gave good indications of becoming a producer in a hitherto untapped area, while ONGC's Mehsana project in Gujarat, north of Ahmedabad, also gave indications of success. The offshore area near Aliabet Island in the Gulf of Cambay, which has shown promising structures by geophysical methods, remained undrilled through yearend 1968, and plans for commencement of drilling in March 1969 that were announced in early 1968 were postponed at least until March 1970. Reportedly, the postponement was the result of delays in delivery of specifications and design data by Soviet technical assistance teams, which was to be used in turn to produce the necessary major equipment in India.

In addition to the relatively near-shore Aliabet Island anomalies, a structure termed the "Bombay High" was indicated in much deeper water by Indo-Soviet seismograph work during 1965–66. Soviet specialists have declined to assist India in planning deep drilling, admitting a lack of competence. Subsequently, five experienced non-Communist-world firms bid for participation and at yearend 1968, all five offers remained under consideration, together with a proposal that the project be conducted wholly by Indian interests.

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Refining.—India's eight refineries recorded receipt of 122.8 million barrels of crude oil in 1968, 13 percent more than in 1967. Of the total, 63 percent was imported and the balance was of domestic origin. Refinery crude runs and production by plant was reported as follows in 1968:

Refineries	Million barrels [1]	
	Crude runs	Production
Private sector:		
Digboi	3.9	3.7
Burmah-Shell	27.9	26.8
Esso	18.7	18.3
Caltex	11.3	10.8
Subtotal	61.8	59.6
Public sector:		
Gauhati	6.1	5.6
Barauni	12.1	11.3
Koyali	21.7	20.3
Cochin	18.7	18.3
Subtotal	58.6	55.5
Total	120.4	115.1

[1] Data differ slightly from that appearing in table 1 owing to differences in sources.

Total refinery output was 11.5 percent above that of 1967 chiefly as a result of output increases by the public sector refineries (led by Koyali). In the private sector, the Caltex refinery showed improvement as a result of special permission from the Government to process crude oil in a quantity greater than that originally authorized; the remaining three private sector refineries processed marginally lower amounts of crude in accordance with the Government's declared policy of securing a dominant position in the market for public sector operations. Caltex was permitted to exceed its programed rate owing to a fuel shortage in eastern India, where the new public sector Madras refinery did not go onstream according to schedule.

Performance of the public sector refineries was mixed, despite the fact that all four plants exceeded 1967 output levels. The Koyali, Cochin, and Barauni refineries all performed near to or in excess of rated capacity, while the Gauhati refinery reportedly continued to operate at an economic loss. In addition to the four operating public sector refineries, a fifth, the 50,000-barrel-per-day refinery under construction at Madras, was scheduled for completion in June 1969, and a sixth, the 50,000-barrel-per-day Haldia refinery, was progressing slowly with completion not expected until late 1971 or early 1972. No progress was reported on a planned facility termed the Northwest Refinery, which the Government was contemplating for a site at New Delhi or Kandla.

In addition to the nation's eight operating refineries, two lubricating oil blending plants operated in 1968. These plants, at Bombay and Calcutta, are owned by Indian Oil Blending Ltd., an equal partnership Indian Government-Mobil Petroleum Company of New York venture, and operated on imported feedstocks in 1968. The Bombay plant is expected to begin obtaining feedstock from a facility of Lube India Ltd., Bombay, when this $20 million plus installation is completed. This firm, an equal partnership venture between the Government of India and Esso Standard Eastern, in turn will receive its feedstock from the Esso private sector refinery. Other speciality plants include a transformer oil facility of unreported capacity in Bombay that opened during 1968 and a 6,000-ton-per-year chemical additives plant in Bombay slated for completion in January 1969.

Transportation.—The bulk of petroleum products moved in India continued to be transported by rail in 1968. Road transport, however, although more costly, was resorted to in order to overcome delays inherent in the rail system, particularly to meet shortages of supplies in some areas. Coastal tankers play a significant role in product distribution along the coast, and pipelines, though meager, are also becoming more important. At yearend, three product lines totaling 1,077 kilometers were in operation.

In the case of crude oil and natural gas movement, pipelines were of increasing importance, but at yearend, only four crude oil lines totaling 1,275 kilometers and four natural gas lines totaling 182 kilometers were in operation. In addition a 130-kilometer, 9-inch crude line from Kalol to Koyali was under construction, with completion slated for 1970. Additional lines for both crude oil and gas are being planned but were not yet under construction at yearend.

Marketing.—The public sector Indian Oil Corporation (IOC) increased its share of product distribution from 36 percent in 1967 to 42 percent in 1968, owing largely to the rising volume of products available to it for sale. Private companies handled

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about the same volume as in 1967, but had a lower share of the total because of IOC's growth, which was about 33 percent over its 1967 level. Private refineries have suffered somewhat as a result of assignment of interior markets, with attendant high transport costs, as well as from being assigned only small shares of total nearby markets, making the maintenance of retail outlets unprofitable.

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The Mineral Industry of Indonesia

By Arthur F. Grube [1]

The mineral industry of Indonesia continued to make further progress during 1968. The reason for this progress is not found primarily in 1968 minerals' production but rather from the progress made in attracting additional foreign private capital to invest in Indonesia. Crude oil continued to provide the major share of the country's mineral related income, and bauxite, tin, nickel, and cement most of the balance. About 31 percent of the crude petroleum produced was refined in Indonesia by the Government refineries and the one refinery of P. T. Stanvac Indonesia, a U.S. company. The remaining crude oil was exported, primarily to Japan.

The processing of applications for mining operations during 1968 had progressed sufficiently to justify expectations that the mining sector will attract the major part of future foreign investments. By yearend agreements reached between the Indonesian Government and U.S., Japanese, and other foreign companies could involve the investment of some $300 million during the next 5 years. In addition to agreements for the development of the nation's crude oil deposits, four agreements relating to general mineral exploration and several regarding the development of nickel, copper, tin, bauxite, and kaolin, had also been concluded. The scale and diversification of this interest in Indonesian mineral resources has been a direct result of current government policy creating a favorable climate for foreign investment. In addition to the income derived from these mineral agreements, Indonesia received direct foreign aid in the amount of approximately $265 million during 1968.

Legislation and Government Programs.—Basic conditions for mining investments other than petroleum were stipulated in the Foreign Investment Law and a new mining law, Law Number 11 of 1967. All mineral investment is on the basis of contractual arrangement, rather than through the granting of concessions and leases. The company is appointed sole contractor to the Government to conduct the exploration, development, mining, processing, and marketing of minerals obtained from the contract area. The Government, however, retains ownership of the mineral deposits. Contracts granted companies for mineral exploration and development, exclusive of petroleum, generally provide that the company shall have control and management of all its activities under the agreement; however, the company assumes all the risks. Most of the contracts also provide that the company may apply, on a priority basis, for the development of any other minerals it may encounter in its contract area. Work stages of the following duration are permitted: General survey, 12 months; exploration, 36 months; evaluation, 12 months; construction, 36 months; and exploitation, 360 months. Extensions of individual work periods are generally granted. The law requires that the company must process the minerals to a maximum extent prior to export.

During the exploitation period a new company must be formed under Indonesian laws to which all rights and obligations must be transferred. The company must pay the Government rent for land in the contract area; royalties on minerals produced; corporation taxes; sales taxes; stamp duties; and a tax on transfer of ownership of motorized vehicles and shops. Land rents are assessed annually on the basis of $0.005 per hectare during the general survey period; $0.10 during the exploration, evaluation and construction period; and $2 per hectare for primary and alluvial deposits, or $1 per hectare for lateritic and other extensive surface deposits during the operation period. Corporation taxes are

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levied in accordance with Presidential Instruction Number 18 of 1968, which is applicable to all minerals with the exception of petroleum. For the first 10 years the tax is 40 percent of net profits for tin; 37.5 percent for nickel, cobalt and bauxite; and 35 percent for other minerals. For the duration of the contract period the rate is 48 percent of net profits for tin; 45 percent for nickel, cobalt, and bauxite; and 42 percent for other nonoil minerals.

PRODUCTION

Indonesia's 1968 mineral production performance was mixed. Substantial increases in crude oil, nickel, and tin output were offset to a minor extent by decreased bauxite, gold, and coal production. The significant increase in crude oil production was primarily due to expansion at the central Sumatran oilfields of P. T. Caltex Pacific Indonesia. The performance of the petroleum industry during the past several years strongly indicates that the relative importance of crude oil to the domestic economy will become even more pronounced in the years to come. Increased production of nickel and tin over the 1967 level resulted from more efficient management of mining operations.

Bauxite output was adversely affected by unfavorable market conditions, and the decrease in gold production was the result of lower gold content of the ore being mined. The coal industry, as in the past, suffered from the decreasing number of markets open to Indonesian coal.

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Table 1.—Indonesia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum: Bauxite, gross weight	647,805	688,259	r 701,473	920,166	879,328
Gold, metal[1]—troy ounces	5,813	6,752	4,122	7,752	5,968
Lead	650	NA	NA	NA	NA
Manganese ore	r 6,774	r 1,205	NA	NA	1,000
Nickel, mine output, metal content e	1,678	3,570	r 3,933	r 5,118	7,859
Rare earth metals, monazite sand	r 140	r 24	NA	NA	e 25
Silver—thousand troy ounces	253	299	221	309	309
Tin:					
Mine output, metal content—long tons	16,345	14,698	12,567	13,600	16,563
Metal—do	r 1,363	r 1,189	r 822	r 1,481	4,885
NONMETALS					
Asbestos	r 36	r 590	----------	----------	----------
Cement—thousand tons	439	365	338	e 350	411
Clays, kaolin e	8,290	r 7,500	r 7,500	r 7,500	7,500
Diamond, (Government estimates):					
Industrial—carats	r 21,000	r 21,000	r 21,000	r 21,000	21,000
Gem—do	r 14,000	r 14,000	r 14,000	r 14,000	14,000
Total—do	r 35,000	r 35,000	r 35,000	r 35,000	35,000
Fertilizer material: Phosphate rock	3,408	e 3,500	e 10,000	e 10,000	e 10,000
Iodine (content of cuprous iodide)—kilograms	4,904	r 3,384	NA	NA	NA
Salt, all types:					
Government (reported)—thousand tons	NA	252	e 250	e 250	e 29
Private (estimated)—do	NA	NA	NA	NA	e 50
Sulfur, elemental	1,695	r 3,573	e 1,200	e 1,200	e 1,200
MINERAL FUELS					
Asphalt rock, bitumen content	5,315	9,080	e 10,000	e 10,000	e 10,000
Coal	445,862	390,253	319,829	208,363	175,673
Gas: Natural:					
Gross production e—million cubic feet	NA	NA	NA	NA	115,045
Marketed e—do	13,000	15,000	18,000	22,000	24,066
Natural gasoline—thousand 42-gallon barrels	NA	NA	NA	NA	260
Petroleum:					
Crude—do	171,492	178,991	168,429	r 186,231	219,912
Refinery products:					
Gasoline—thousand 42-gallon barrels	14,142	e 13,685	10,600	10,344	10,991
Kerosine and jet fuel—do	11,000	e 9,846	13,000	13,419	14,317
Distillate fuel oil—do	10,716	e 9,987	10,800	11,126	13,672
Residual fuel oil—do	12,581	e 15,000	11,800	10,784	12,890
Other [2]—do	15,983	e 25,343	20,415	18,319	15,978
Total [3]—do	64,422	e 73,861	66,615	63,992	67,848

e Estimate. r Revised. NA Not available.

[1] Officially reported Indonesian statistics representing Government output; private production by small unorganized producers may be as much as 30,000 troy ounces per year.

[2] Includes unfinished oils requiring further processing.

[3] Excludes refinery fuel and losses.

TRADE

According to preliminary data overall trade increased moderately in 1968. Exports increased by 12 percent, and imports increased by 3 percent. The nation again achieved a positive trade balance after recording a trade deficit in 1967. Estimated value of foreign trade is as follows, in millions of dollars:

Year	Exports	Imports	Balance
1964	724	622	102
1965	708	718	—10
1966	r 714	r 604	r 110
1967	770	802	—32
1968	p 860	p 826	p 34

p Preliminary. r Revised.

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Mineral commodity exports continued to be a significant factor in the country's trade, accounting for nearly one-half the total value. Exports of crude oil and relatively small amounts of refined products valued at $290 million accounted for one-third of the country's total exports. Mineral commodity imports, however, were only a small proportion of the country's trade.

Japan continued as one of Indonesia's major customers during 1968, and was also a major source of Indonesia's mineral imports. During 1968 Japan shipped 140,092 metric tons of cement to Indonesia, 90,275 metric tons of iron and steel products, and 24,442 metric tons of manufactured fertilizers.

Table 2.—Indonesia: Exports of selected mineral commodities to Japan[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	1968
METALS			
Aluminum: Bauxite	608,760	771,648	757,310
Iron and steel, scrap	1,486	17,843	3,382
Manganese ore	2,106	7,176	6,238
Nickel, ore and concentrate	133,658	128,455	234,960
MINERAL FUELS			
Crude oil[2]—thousand 42-gallon barrels	38,889	r 47,777	67,317
Distillate fuel oil—do	458	440	548
Residual fuel oil—do	3,454	4,929	11,641

r Revised.
[1] Data shown in lieu of official Indonesian export figures.
[2] Includes unfinished oils.
Source: Official trade returns of Japan.

Table 3.—Indonesia: Trade in selected mineral commodities, 1966[1]

Commodity	Quantity (metric tons)	Value (thousands)	Principal sources or destinations
IMPORTS			
Aluminum, metal, including alloys, all forms	2,401	$1,915	Japan and West Germany.
Cement	43,283	766	Mainly from Japan.
Copper, metal, including alloys, all forms	1,082	2,184	Yugoslavia and Italy.
Iron and steel, metal, including alloys and semimanufactures	NA	17,740	Mainly from Japan, West Germany, and Italy.
Petroleum, crude oil and refined products[2]	NA	6,343	Mainly from the United States.
Sulfur, elemental, all forms	6,306	260	Do.
EXPORTS			
Aluminum, bauxite	660,345	6,086	Japan, Italy, West Germany.
Manganese ore	2,106	75	Japan.
Nickel ores and concentrate	133,653	2,048	Do.
Petroleum, crude oil and refined products	NA	227,710	Japan, Australia, United States.
Tin:			
Ore and concentrate	13,703	34,975	Netherlands.
Metal, including alloys, all forms	1,509	5,581	France and West Germany.

NA Not available.
[1] Derived from United Nations data on countries trading with Indonesia; represents bulk of mineral trade but not the total. Trade with Communist countries is excluded.
[2] Primarily lubricants.

COMMODITY REVIEW

METALS

Aluminum.—At yearend 1968 Indonesia and the Aluminum Company of America (ALCOA) had completed negotiations regarding the exploration and development of certain bauxite deposits. A contract was signed on April 2, 1969. Under the contract terms ALCOA was granted large areas in and around eastern Sumatra and western and southeastern Kalimantan. The company is to establish initial aluminum processing facilities if the deposit so warrants, and at a later date will consider expanding the facilities provided that the proposed hydroelectric dam on the Asahan

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River in Sumatra is built. This was the first bauxite exploration contract ever granted by Indonesia to a foreign company.

Negotiations leading to still another bauxite development contract were reported as being nearly concluded. The applicants, Nippon Light Metal, Showa Denko K.K. and Sumitomo Chemical Co. Ltd., all of Japan, were negotiating for a contract to explore and develop new bauxite reserves on Bintan Island. If economically recoverable reserves are discovered, these firms would consider constructing an alumina plant on the island.

In early 1969 the Associated Metals and Minerals Corporation of New York was appointed exclusive worldwide, except for Japan and Taiwan, sales agents for bauxite produced by P. N. Aneka Tambang of Djakarta.

Indonesian 1968 production of bauxite was 879,323 metric tons of which 847,751 metric tons was exported. Japan was the destination of 748,096 metric tons, the balance going to Europe, primarily Italy.

Copper.—Freeport Sulphur Co. announced that preliminary surveys and reports concerning copper deposits in the company's contract area in central West Irian were sufficiently encouraging to warrant additional feasibility studies. Assays of extensive drillhole cores indicated the presence of approximately 33 million tons of mineralized material containing 2.5 percent copper, 40.6 percent iron, and approximately 0.02 ounce of gold and 0.3 ounce of silver per ton. Studies indicated there will be no metallurgical obstacles to separating the metals from the ore. At yearend the company was negotiating with Japanese copper smelters regarding sales of copper and a loan for development of the deposit.

Late in 1968 Kennecott Copper Corp. had submitted a draft proposal involving copper in West Irian and general exploration in central Java. Negotitations were continuing at yearend.

Gold.—The only recorded production of gold was from the Government-owned Tjikotok mine on the island of Sumatra. Higher gold prices would undoubtedly result in the reopening of other Sumatran gold mines.

Iron and Steel.—The Indonesian Government was negotiating with the U.S. concern, Granite City Steel, regarding completion of a half-finished steel plant at Tjilegon, 50 miles west of Djakarta. The plant was started by Soviet technicians, but work ceased when the U.S.S.R. stopped financial aid for the $36 million plant. In mid-1969 Granite City Steel decided not to participate in the rebuilding due to the large investment required.

At yearend 1968 Japanese steel companies were planning to construct several galvanized iron sheet plants in Indonesia. The Fuji Iron and Steel Company, with the cooperation of Mitsui Bussan and Indonesian interests, plans to build a plant at Semarang, Java; and the Kawasaki Corporation, with the cooperation of C. Itoh and Indonesian interests, intends to build a plant at Medan, Sumatra. The Government has given approval for both of these projects.

Manganese.—A preliminary contract was signed by the Japanese Mitani Metropolitan Company and the west Java Development Corporation for the exploitation of manganese in Tasikmalaja, West Java.

Nickel.—During 1968 and the early part of 1969, the Indonesian Government signed two final contracts and one provisional contract with various foreign companies for the development of the country's nickel deposits. The first contract, signed in July 1968, was with the International Nickel Company of Canada, Ltd. in which U.S. investors have a substantial interest. It covers some 27,500 square miles onshore and offshore of the Celebes (Sulawesi) Island. The contract provided for a minimum production period of 30 years with liberal terms on the exploration period. Although total investment depends on evaluation studies, the project may involve an investment of $100 to $150 million. Anticipated nickel production will be 12,000 to 23,000 tons annually. For conducting its Indonesian operations International Nickel of Canada formed a subsidiary company called P. T. International Nickel Indonesia. This subsidiary awarded a contract to Taylor Woodrow International for the supply and management of the facilities needed during the exploration program.

The second contract was signed on February 17, 1969, between the Indonesian Government and an international group of companies. These companies and their

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share interest are: United States Steel Corp., 43 percent; Newmont Mining Corp., 15 percent; Sherritt Gordon Mines, Ltd., 10 percent; Koninklijke Nederlandsche Hoogovens en Staalfabrieken N.V., 22 percent; and William H. Muller, 10 percent. A company called P. T. Pacific Nickel Indonesia was formed to conduct operations in Indonesia. The contract area covers Waigeo Island and Cyclop Mountains on the northwest coast of West Irian. If adequate reserves are found, the company has the right to develop facilities for producing pure nickel and mixed cobalt and nickel sulfide. The plant would use the hydrometallurgical process developed by Sherritt Gordon. If the project is completed, over 50 million pounds of nickel would be added annually to the world's output. Production of this amount of nickel would involve the annual processing of 3 million tons of ore. The contract anticipates a minimum investment of $75 million.

The third contract, a provisional one, was signed in February 1969 between the Government and four Japanese companies: Sumitomo Metal Mining Co., Ltd.; Nippon Mining Co., Ltd.; Nippon Yakin Kogyo; and Pacific Nickel Mining Company, a subsidiary of Mitsubishi Metal Mining Co., Ltd. Reportedly at least four other Japanese firms have joined the group since the provisional contract was signed; these are the Yawata Iron and Steel Co., Ltd., Fuji Iron & Steel Co., Ltd.; Mitsui Mining Co., Ltd.; and Sumitomo Shoji Kaisha Ltd. These companies formed the Indonesia Nickel Kyoda Kainatsu Company. Under terms of the contract the company will prospect, exploit, and refine mineral resources, primarily nickel, in Halmahera Island, Ceram Island, and other eastern Indonesian Islands covering an area of about 3.9 million hectares. A 3-year exploration program is planned and, if the deposits can be economically exploited, a ferronickel refinery will be built with a capacity of 1,000 to 2,000 tons per month.

Indonesian production of nickel ores and concentrates was 261,973 metric tons in 1968 with an estimated metal content of about 3 percent. Practically all of the production was shipped to Japan.

Tin.—Prospects for greater exploration and development of tin reserves appeared quite favorable at yearend. The Indonesian Government had awarded one contract for tin exploration, and three others were in the final stages of negotiations. The signed contract, dated July 1968, was with the Netherlands company, N. V. Billiton Maatschappij and has a duration of 40 years. The contract covers two large offshore areas totaling about 12,000 square miles; one is between the islands of Singkep and Bangka; and the other is off the southwest coast of Kalimantan. Billiton intends to start its estimated $2 million exploration program immediately, and has instructed Coastal Engineering Survey Consultants to make a geophysical survey. If exploration reveals worthwhile deposits, the company has agreed to make an initial investment of at least $6 million. Initial prospecting operations are expected to take 4 to 7 years. Billiton was an early pioneer in the development of Indonesian tin deposits. The company, before its Indonesian properties were nationalized in 1958, held a tin concession on Belitung (Billiton) Islands for nearly 100 years, 1860–1958.

Under study by the Indonesian Government at the close of the year were the following:

1. A draft agreement submitted by a consortium consisting of Bethlehem Steel Corp., Rio Tinto-Zinc Corp. Ltd., and Simmons-Lobnitz. These companies applied for mining rights to an area of 10,000 square miles both onshore and offshore in the Rhio (Riau) Archipelago. If the project is approved, Rio Tinto-Zinc Corp. will conduct exploratory operations.

2. Draft agreements from a consortium consisting of Ocean Science & Engineering Inc.; Amerada Petroleum Corporation; Kathleen Investments (Australia), Ltd.; Dillingham Overseas Corporation; and the Signal Oil and Gas Co. were submitted in March and June 1968. These companies were interested in onshore areas of South Bangka; and selected areas offshore of Belitung.

3. The third contract was submitted by Kathleen Investments (Australia), Ltd., Dillingham Overseas Corporation, and Signal Pacific Company in September 1968. This consortium was interested in the Anambas and Natuna island groups in the South China Sea.

The Japanese firm, C. Itoh & Co., Ltd., which had received rights to explore and develop tin in central Sumatra, relinquished its rights during the year.

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Additional assistance toward the development of the Indonesian tin industry was provided by the United Nations through its development program. This project is aimed toward locating additional offshore alluvial tin ore reserves, improving tin recovery from such sources, and training Indonesian nationals.

In early 1968 Indonesia's three state tin mining enterprises, located on the islands of Bangka, Belitung, and Singkep, were merged into one company, P. N. Tambang Timah Indonesia. Badan Pimpinan Umum Perusahaan Tambang Timah Negara, the federal management board for tin, was abolished. This reorganization was in line with presidential instructions to simplify the structure of governmental agencies. Also, to encourage the increased production of tin, the Government allowed tin mining companies to retain 95 percent instead of the 75 percent previously allowed of their foreign exchange earnings.

The Government-owned 25,000-ton-per-year tin smelter at Muntok, Bangka Island, was still operating far below capacity at yearend 1968. In the meantime, Indonesia was sending some of its tin ore to Malaysia for smelting at the Butterworth works of the Straits Trading Co., Ltd.

One obstacle standing in the way of increased tin production was the decision of the International Tin Council to place export controls upon producing member countries. Indonesia's quota was set at 4,040 long tons for the September–December 1968 period, and 3,575 long tons for the January–March 1969 period. Unfortunately, the export restrictions were based upon production figures for the 1965–67 period when Indonesian output was at an extremely low level. The metal content of mine output was 14,698 long tons in 1965; 12,567 in 1966; 13,600 in 1967; and 16,563 in 1968.

NONMETALS

Cement.—The rebuilding of the Czechoslovakian-built 375,000-ton-per-year cement plant at Tonasa (Tomasak), which burned in late 1967, was completed during 1968. In mid-1968 the Japanese firm Toyo Menka Kaisha of Osaka, Japan, in partnership with Indonesians, commenced the construction of another cement plant at Djakarta. When completed the capacity will be 300 tons of cement per day.

Diamonds.—The managing board of the State General Mining Company is setting up a project for recovering diamonds by mechanical means. The area chosen for this test is the Simpang Ampat-Pengaron region in Kalimantan. This region was chose.. as a result of favorable reports of reconnaissance parties which were then followed up by detailed geological explorations during 1966–67. The region has a further advantage in that it is reasonably accessible by highway. A large part of the equipment needed for the actual mining has been delivered to Indonesia and is presently stored at Simpang Ampat. No date has been set for the actual start of operations.

The Asscher Diamond Company of the Netherlands cuts and markets diamonds produced in Indonesia in accordance with a letter of intent signed by the company and the Indonesian Government. Indonesian diamond miners are required to sell all the diamonds produced to the Government.

Fertilizer.—Reportedly the Indonesian Government and the Italian firm Consindit S.p.A. have agreed to resume construction of the $56.1 Petrokima fertilizer plant in central Java. Under the renegotiated contract the cost will remain the same; however, the harbor, road, and railway work included in the terms of the original contract will not be performed by Cosindit.

The U.S. Government has agreed to provide financial assistance for the execution of preliminary feasibility studies on expanding the capacity of the urea plant at Palembang from 100,000 to 400,000 tons per year. The existing anhydrous ammonia (NH_3) plant would also be expanded.

Late in 1968 it was announced that a contract had been signed between the Indonesian Oil and Gas Mining State Enterprise (Pertamina) and Universal Chemicals, Ltd., providing for the construction of a $65 million fertilizer plant in West Java. The planned capacity of the plant is 1,700 tons of urea per day. While the plant is being designed, Pertamina and Universal Chemicals will set up a modern distribution system for the express purpose of delivering fertilizers to farmers at a price they can afford.

Kaolin.—In August 1968, Crown Lynn Potteries, Ltd., submitted a proposal for

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the development of kaolin deposits on Bangka and Belitung Islands. The Indonesian State Tin Enterprise and Keramika Indonesia, Ltd., have expressed interest in participating in this proposed venture.

MINERAL FUELS

Asphalt.—Indonesia continues to produce rock asphalt from open-pit mines on Butung Island. The rock is crushed on the site and shipped to the region where it is to be used. There it is mixed with sufficient crude oil to liquefy the bitumen content, usually about 5 percent of the weight of the crushed asphalt. Butung's output accounts for over 25 percent of the country's total asphalt production. The asphalt plant of Pertamina located at Wonokromo produced 132,000 barrels during 1968. About 120,000 barrels of asphaltic crude was imported from Kuwait; the remainder of crude used at the asphalt plant was Indonesian in origin.

Coal.—The Government-owned Ombilin coal mines in West Sumatra have been granted an investment credit of Rp80.75 million (about $315,000) by the Indonesian Development Bank. The credit is to be used to modernize the mines, thereby increasing production. New equipment and machinery were obtained from Poland under terms of a 1966 agreement between the two countries, and most of this equipment has arrived in Indonesia. The completion of the project is set for 1975. Total 1968 coal production amounted to only 175,673 tons. After modernization of the Ombilin mines, coal production from these mines alone is expected to reach 300,000 tons per year.

Petroleum.—Crude oil production during 1968 of 220 million barrels was somewhat of a disappointment, since a larger increase over 1967 production had been expected. Oil accounts for about 3 percent of the country's net domestic product, and 21 percent by value of Indonesia's total exports. In 1968, Indonesia was the world's 11th largest producer of crude oil.

During 1968 the rush of foreign petroleum companies to secure exploration contracts in Indonesia continued unabated. By yearend Pertamina, the Indonesian Government-owned oil company (formed by a merger during the year of Permina and Pertamin, the two former Government-owned oil companies), had concluded 17 contracts for petroleum exploration and one rehabilitation contract. Of the 17 exploration contracts 11 were with U.S.-owned companies, one with a U.S.-Australian group, two with an Italian company, one with a French company, one with a Canadian company, and one with an Australian company. Contracts signed with U.S. companies were as follows: Phillips Petroleum Co. in partnership with Superior Oil Company secured a tract of some 125,000 square miles off West Irian in the Afura Sea. Phillips is the operator for the two companies. Texas International Corporation contracted for an area in Halmahera (Moluccas) Islands. The Indonesian operating company is named Indonesian Texas Petroleum Company (Indotex). The Independent Indonesian American Petroleum Company (IIAPCO) signed its second contract during 1968 for a 42,460-square-mile area just southeast of South Sumatra. Continental Oil Company was awarded a 41,000-square-mile tract in the South China Sea. This is the second contract for this company; the first was for an onshore area in southern Kalimantan.

A combine consisting of the Virginia International Oil Company and Roy M. Huffington acquired an offshore South Sumatran area as well as an area onshore on Kalimantan. Mobil Oil Corp., acting in its own behalf, acquired two areas during 1968, one from Pertamina and another from Asamera Oil Corporation. The contract with Pertamina gave Mobil an area of about 16,000 square miles offshore, northeast of Sumatra. The area acquired from Asamera was onshore North Sumatra and includes about 1,200 square miles. Both of these operations are separate from the company's 50-percent ownership of P. T. Stanvac Indonesia, an Indonesian producing and refining company. Standard Oil Co. (New Jersey) owns the other 50-percent interest. Union Oil Co. was awarded three new areas for petroleum exploration and exploitation during 1968; the company had signed a previous contract in 1967 for acreage in North Sumatra. The new areas award the company exclusive rights over some 3,700 square miles off the east coast of Kalimantan and 1,300 square miles onshore Kalimantan. The area off the east coast of Kalimantan is contained in two separate blocks. The Southeast Asia Oil

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and Gas Company has on- and offshore areas near the southern tip of the Celebes (Sulawesi) Islands. Frontier Petroleum Incorporated signed a contract for acreage in the South China Sea.

Gulf Oil Corp. entered the Indonesian scene for the first time and secured a 65,260-square-mile block in the South China Sea. The 11th contract with U.S. interests was between Pertamina and Caltex. This contract gave the company an extension of acreage adjacent to their existing contract area.

The two contracts representing Italian interests were both with the Italian company Agip S.p.A. Agip is a subsidiary of the Italian Government-owned Ente Nazionale Idrocarburi (E.N.I.). These contracts gave the company an area of 38,000 square miles offshore of western West Irian in the South China Sea and an area onshore Timor. The contract signed with French interests was between Pertamina and Compagnie Francaise des Petroles (CFP). CFP secured on- and offshore acreage near Djambi in central Sumatra. The area covers about 13,600 square miles. The agreement is the first involving a major French concern in Indonesia since the recent change in the Indonesian Government. The Indonesian operating company is named Total Indonesia. A consortium of Australian and U.S. companies consisting of Cities Service Oil Co., Ashland Oil Co., and Australian Drilling Co. secured a contract for an area of 56,000 square miles offshore northeastern Java. The Canadian contract was with the Java Sea Oil Co., a subsidiary of the Canadian firm Bawden Drilling Company, Ltd. This company obtained acreage in the Java Sea. Finally, the Australian company, International Oils of Australia, secured on- and offshore areas in Timor.

A number of factors have favored the continued interest of petroleum companies in securing exploration contracts in Indonesia. Among them are the desire of the companies to diversify their crude oil supplies; the improved investment climate in Indonesia; and the low sulfur content of Indonesian crude oils.

All these contracts are on a production-sharing rather than a profit-sharing basis, and are between the oil companies and the Government petroleum company Pertamina. Since the signing of the first production-sharing agreement in the summer of 1966 with IIAPCO, the Indonesians have won increasingly stiffer terms. The first contracts had relatively few exploration commitments, no signature bonus, and no production bonus. The contractor, however, had to bear all expenses. Upon the commercial discovery of oil the contractor was entitled to 40 percent of production to recover his cost; the remaining production was split on a 65–35 basis in favor of Pertamina. After the company recovered its expenses the split became 65–35 again in favor of Pertamina. The latest contracts have included signature bonuses as high as $7 million, exploration commitments ranging up to $22.5 million over a 10-year period, and production-bonus increments as high as $5 million each at 50,000; 100,000; 200,0000; and 300,000 barrels per day. The production sharing has also inched upward with the final split ending at 67.5 to 32.5 percent in favor of Pertamina. Additionally, recent contracts have vested management control with the Government. Signature bonuses paid during 1968 are estimated to be in excess of $25 million.

An agreement was made by Pertamina with Rehabilitation Engineering and Development Company (REDCO), whereby the latter will perform secondary recovery work in declining oilfields and rehabilitation work in some which have been run down and abandoned in Sumatra, Java, and Kalimantan.

Pertamina announced plans to build two refineries at Dumai and the other on Java, to serve the domestic market. Negotiations with Japanese companies for construction of the Dumai refinery were nearly concluded, but nothing definite has been decided with regard to the Java refinery. The Japanese-Indonesian firm, Far East Oil Trading, entered into a contract with Sumitomo Trading and Ishikawajima Harima for the construction of a 100,000-barrel-per-day refinery. The latter two Japanese firms are concerned respectively with trading and engineering and will supply equipment valued at $28 million. The U.S. company, Foster Wheeler Corp., will be the main contractor for the plant which is to be completed by mid-1971. Repayments to the Japanese will be made in fuel oil from the refinery over an unspecified period.

Several companies reported oil and gas discoveries during the year. The Asamera

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group of companies announced one oil and one gas discovery in the Djeulen Rajeu area, and Caltex announced a discovery 40 kilometers northwest of Duri, North Sumatra. In addition, Japex Indonesia reported a gas discovery offshore from North Sumatra, but the well has been sealed for safety reasons. At yearend testing of these discoveries was continuing.

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The Mineral Industry of Iran

By David A. Carleton[1]

Iran's strengthening economy was bolstered again in 1968 by sizable increases in petroleum production and petroleum revenue. A growing share of these revenues has been used to diversify the economy and to lessen the country's dependence on petroleum. During the Third Development Plan, covering 5½ years ending March 1968, Iran allocated $2 billion out of total oil revenues of nearly $3 billion to development. In the Fourth Development Plan (1968–73), the portion of oil revenues assigned to development is to rise to 80 percent.

Although the tempo of mineral development, other than oil, has quickened in recent years, mining operations are still small compared with other economic activity. In an effort to boost mineral development the Plan Organization announced in 1968 the signing of an agreement with four large U.S. industrial firms for a comprehensive study of the overall development of the Greater Bander Abbas region of southern Iran, to include some of the country's best mineral deposits.

Iran's rapid pace of economic expansion during the past 8 years ranks with the fastest among the developing countries. The economy achieved an average growth rate during that period of 7 percent annually, with a 10 percent yearly gain since 1964. Gross national product (GNP) grew about 12 percent in 1968 totaling $8.3 billion. GNP per capita was $300 in 1968 compared with $200 in 1960. Despite rapid growth, domestic prices have remained relatively stable.[2] The petroleum industry contributes about 12 percent to the country's GNP.

Petroleum revenue contributes substantially to total government revenue. During 1967, $723 million was paid to the Government of Iran as royalties and taxes, up about 22 percent from that in 1966. Oil revenue during 1967 amounted to 48 percent of total government income and together with oil company purchases in Iran oil companies contributed about 60 percent to Iran's foreign exchange receipts.[3] Based on preliminary estimates[4] Iran's oil revenue for 1968 was about $850 million.

PRODUCTION

In 1968 Iran, became the world's fourth largest crude oil producer, after the United States, the U.S.S.R., and Venezuela. By outproducing Saudi Arabia and Kuwait, Iran regained the lead in the Middle East for the first time since 1952 when the Iranian oil industry was nationalized. The value of crude oil production in 1968 was about $1.5 billion (based on estimated realized prices), 6 percent above that in 1967. There are no definitive data on the value of mineral production, other than petroleum; however, according to the Iranian Ministry of Economy the value increased 17 percent during 1968.

[1] Supervisory foreign mineral specialist (Petroleum), Division of International Activities.
[2] Business World. No. 15, April 1969, p. 22.
[3] Iranian Oil Operating Companies, Tehran, Iran. Statistics 1967. P. 22–24.
[4] Organization of the Petroleum Exporting Countries. OPEC Bulletin. Vienna, Austria, May 1969, p. 5.

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Table 1.—Iran: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Chromite	98,000	129,000	140,680	150,000	160,000
Copper ore (3 to 8 percent copper)	8,835	9,577	11,000	12,000	12,000
Iron ore	1,833	2,210	3,000	3,000	3,000
Lead:					
Ore (30 to 65 percent lead)	26,600	29,200	36,700	37,000	37,500
Ingots (smelter output)	375	333	351	350	350
Manganese	32,000	36,570	41,000	42,000	43,000
Zinc (5 to 60 percent zinc)	47,720	87,800	88,520	89,000	90,000
Zinc and lead (12 percent lead, 30 to 40 percent zinc)	21,900	27,700	20,000	20,000	20,000
NONMETALS					
Barite	43,000	62,500	84,300	90,000	95,000
Cement, hydraulic thousand tons	745	785	1,394	1,395	1,400
Gypsum do	760	810	850	1,093	982
Ochre	7,174	8,980	9,310	9,500	9,700
Salt thousand tons	239	240	245	259	275
Sulfur	17,000	32,400	34,000	36,600	38,000
MINERALS FUELS AND RELATED MATERIALS					
Coal thousand tons	274	285	285	290	300
Coke do	21	20	22	21	21
Natural gas million cubic feet	415,400	509,900	632,456	709,238	802,490
Marketed do	42,102	43,423	48,957	51,784	55,584
Petroleum:					
Crude (net) [2] thousand 42-gallon barrels	618,731	688,213	771,234	947,678	1,039,366
Refinery products:					
Aviation gasoline do	5,035	6,359	6,502	6,477	6,533
Motor gasoline do	12,758	13,354	13,105	12,859	15,818
Naphtha and solvents do	5,154	1,745	1,691	3,018	2,964
Jet fuel do	7,497	9,763	10,564	10,343	12,617
Kerosine do	16,681	15,412	15,374	14,220	17,579
Distillate fuel oil do	21,107	22,093	23,367	23,250	27,390
Residual fuel oil do	66,229	67,692	70,200	73,947	72,939
Lubricants do	247	313	370	327	448
Asphalt do	1,227	1,105	1,898	1,965	1,654
Liquefied petroleum gas do	154	209	302	447	530
Other do	1,412	2,087	3,523	3,180	9,251
Total do	137,501	140,132	146,396	150,033	167,723
Refinery fuel and loss do	10,809	9,799	8,139	9,555	11,742

p Preliminary.

[1] Except for natural gas and petroleum, data are for the calendar years beginning 21 March of the year indicated. Most of the data for 1964–67 are revised based on the latest estimates by the Ministry of Economy and a new statistical publication of the National Iranian Oil Company. Except for petroleum and natural gas, 1968 data are Bureau of Mines "guesstimates".

[2] Excludes petroleum reinjected into the fields.

TRADE

Petroleum continued to be the principal export commodity of Iran. Exports of crude oil and refined petroleum products totaled $1.4 billion (based on estimated realized prices) during the Iranian year ending March 20, 1968, accounting for about 90 percent of the total value of exports. The trading companies of the Consortium (Iranian Oil Exploration and Producing Company and the Iranian Oil Refining Company) account for 95 percent of the exports and Europe and Japan are the major destinations. Japan alone accounted for about 35 percent in 1967.

Exports of metal, and nonmetal ores were valued at about $9 million during the Iranian year ending March 20, 1968, down from $11 million in the previous year. Most of the decline resulted from a fall in chromite exports. Iron and steel product imports were valued that year at $187 million or 15 percent of the value of all imports during the year.

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Table 2.—Iran: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Chromite, 48 percent Cr_2O_3	131,825	88,770	Mainland China 27,000; France 26,110; Czechoslavakia 12,150.
Copper, all forms	160	NA	
Iron and steel, metal:			
Scrap	7,241	3,524	Mainland China 3,000.
Semimanufactures	166	449	Afghanistan 274; Kuwait 115.
Lead, ore and concentrate	44,935	47,485	U.S.S.R. 40,233.
Manganese ore	39,800	10,825	Poland 5,400; Netherlands 3,775; Italy 1,650.
Zinc ore	77,547	40,122	Japan 13,887; U.S.S.R. 10,785; Belgium 6,500.
NONMETALS			
Barite, natural	1,120	3,027	Kuwait 2,576; Muscat and Oman 450.
Cement	92,593	54,593	Kuwait 33,848; Muscat and Oman 16,532.
Chalk	14	166	Kuwait 104; Afghanistan 32; Dubai 30.
Clay	3,292	3,134	Kuwait 2,426; Muscat and Oman 539.
Fertilizers	569	12	All to Kuwait.
Gypsum	2,591	3,004	Kuwait 2,389; Dubai 416.
Lime	r 10,666	NA	
Pigments: Ochre and earth colors	10,469	4,150	United Kingdom 2,100; France 1,000; India 650.
Salt	2,047	3,199	Muscat and Oman 1,554; Kuwait 1,045.
Stone:			
Dimension:			
Marble	3,634	4,180	Italy 3,067.
Other	4,880	3,960	Kuwait 1,764; Japan 774; Italy 443.
Crushed	32,286	40,792	Kuwait 38,597.
MINERAL FUELS AND RELATED MATERIALS			
Coal and lignite	375	153	Kuwait 113; Muscat and Oman 40.
Petroleum:			
Crude oil [2]--thousand 42-gallon barrels	619,012	783,527	Japan 271,300; United Kingdom 123,700.
Refinery products:			
Aviation gasoline--do	6,885	7,720	Singapore 2,448; United Kingdom 843; Republic of South Africa 816.
Motor gasoline--do	14,766	11,219	Republic of South Africa 2,232; United Kingdom 1,808.
Jet fuel--do	9,851	7,422	Singapore 1,941; Malaysia 1,008; Mozambique 812.
Kerosine--do	3,889	3,984	Republic of South Africa 1,282; Singapore 471; Hong Kong 460; Mozambique 453.
Distillate fuel oil--do	11,633	9,471	Pakistan 1,025.
Residual fuel oil--do	52,623	62,993	Japan 21,086; United Kingdom 11,721.
Solvents--do	950	785	Republic of South Africa 251; Singapore 154; Hong Kong 113.
Asphalt--do	448	561	Muscat and Oman 255; Kuwait 109.
Other--do	1,268	915	Republic of South Africa 298; Mozambique 242; United Kingdom 159; Australia 97.
Total--do	102,313	105,070	

r Revised. NA Not available.
[1] Data are for Iranian calendar years beginning March 21 of the year indicated unless otherwise specified.
[2] Calendar year data. Destination data are estimates based on country imports.

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Table 3.—Iran: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum and alloys:		
Unwrought	6,146	4,620
Semimanufactures	2,071	2,855
Copper, metal including alloys:		
Unwrought	428	5,074
Semimanufactures	3,764	7,869
Gold—troy ounces	32,507	32,376
Iron and steel, including alloys:		
Cast iron and ferroalloys	9,684	23,692
Scrap	4,376	5,170
Unwrought	581	3,078
Semimanufactures	747,580	1,211,191
Lead:		
Oxides	211	238
Metals, including alloys:		
Unwrought	2,700	3,368
Semimanufactures	679	531
Nickel, all forms	189	229
Platinum—troy ounces	1,823	648
Silver—do	142,653	113,910
Tin and alloys:		
Unwrought—long tons	236	277
Semimanufactures—do	310	352
Titanium	652	934
Zinc:		
Oxide	446	620
Metal: Semimanufactures	1,098	1,946
NONMETALS		
Abrasives	1,050	1,090
Asbestos	5,009	5,804
Cement—thousand tons	116	40
Clay	12,507	11,743
Fertilizer materials: Manufactured:		
Nitrogenous	7,288	6,979
Phosphatic	37,901	51,291
Potassic	28,183	18,213
Mixed	5,078	4,973
Graphite	r 76	124
Gypsum	------	949
Lime	119	733
Magnesite	------	127
Mica, all forms	281	147
Quartz	------	111
Stone, crushed	------	354
Sulfur	3,777	386
Talc	164	293
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Lubricants thousand 42-gallon barrels	23	40
Other—do	23	20

r Revised.

COMMODITY REVIEW

METALS

Aluminum.—Iran's first aluminum smelter will be built at Arak, not Ahwaz as previously reported. The $46 million project will be owned 75 percent by the Government of Iran, 20 percent by Reynolds Aluminum Co., and 5 percent by the Government of Pakistan. The 45,000-ton-per-year plant is scheduled for completion in 1971 and is expected to have an export bias. Alumina will be imported and power will be supplied from the Pahlavi hydroelectric powerplant north of Andimeshk on the Dez River.

Barite.—Continued closure of the Suez Canal, has created a barite supply problem for Iran. Because of this Sogemiran, S.A., a new lead producer in Iran, is now producing barite concentrate at its 500-ton-per-day flotation mill. At yearend output was averaging 400 tons per day. The new mine and mill are near Delijan, 180 miles southwest of Tehran. The facilities are owned by Union Minière, S.A. (37.5 percent) and three companies in the Société Général de Belgique group.[5]

Chromite.—Deposits of chrome ore estimated at some 10 million tons are believed to be located in mineralized areas in southern Iran, north of Bandar Abbas.[6] Following the virtual cessation of exports of Rhodesian chromite ore and alloys to Europe, Iran's chromite industry benefited by a favorable world market. The export of Iran's ore which is noted for its hard, lumpy quality, rose through 1965. In 1966 and 1967, production increases were meager as exports declined. Prospects for increased chrome ore production were clouded by the breakdown in negotiations between Iranian suppliers and Japanese processors over the price. Japanese companies have agreed to import only 13,500 tons in 1969 compared with the 40,000 tons offered by the Iranians.[7]

Copper.—Although precise data are not available, there is growing optimism about the overall potential of an important copper industry developing in Iran during the

[5] Industrial Minerals (London). No. 17, February 1969, p. 24.
[6] Metal Bulletin (London). No. 5365, Jan. 14, 1969, p. 18.
[7] Metal Bulletin (London). No. 5380, Mar. 7, 1969, p. 21.

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next decade. Exploration and evaluation of the Sar Cheshmeh deposit found in southern Iran in 1966 is being undertaken by Iranian Selection Trust, Ltd., under a joint venture with Kerman Mining Co., an Iranian firm which holds the lease for the deposit.[8] It was reported early in the year that the drilling contractor for Selection Trust had planned to drill 50,000 feet of hole with five rigs during 1968. If successful, it is expected that an open pit mine with a minimum capacity of 10,000 tons daily will be developed. Because of the distance to an ocean terminal (Bandar Abbas, about 110 miles to the south) smelting at or near the mine is believed necessary. The availability of sufficient quantities of water will be a critical factor in determining the scale of mining and processing operations. A water survey is currently being carried out. Reportedly, the Iranian Government is demanding that if the project is feasible a smelter and a 50,000-ton-per-year refinery be built in Iran. Selection Trust, Ltd., has apparently made offers of blister copper to foreign copper companies in return for financial assistance.

Discussions and negotiations between foreign companies and the Iranian Government for developing other copper mineralized areas in southern Iran continued. Representatives of Rio Tinto-Zinc Corp., Ltd., negotiated for exploratory rights in the area while a West German group headed by Metallgesellschaft, A.G. also had discussions involving copper exploration. Furthermore, several East European countries prospected in Iran in 1968. A Yugoslav team was reported to have outlined a copper deposit east of Tehran at Abbasabad, an estimated 5 million tons of copper ore at Chahar Gonbad (150 miles southeast of Kerman), and deposits in excess of 10 million tons near Ahar in northeastern Iran. Data on the copper content of the ore were not given and reserves estimates have not been substantiated.

Iron and Steel.—Construction of Iran's first integrated steel plant began during 1968 about 40 miles southwest of Isfahan near the village of Riz Lenjan. The plant is being built with U.S.S.R. assistance by Iranian National Steel Corp. (INSC), a Government-owned corporation. Initially the plant will have a capacity of about 500,000 to 600,000 tons per year, which under optimum conditions could produce 750,000 tons annually. Scheduled construction stages could increase the plant's annual capacity to 1.2 million tons.

The mill will start with a single blast furnace having a capacity of 1,600 metric tons of pig iron daily. The steel plant will consist of two 80-ton converters and two rolling mills, one for heavy structural steel, the other for light-weight steel products. Future units will include a mill for medium-weight steel products and a sheet metal factory. Final products to be produced will include bars, rods, plates, rails, angles, and girders. Anticipated completion date is 1971.

Lead and Zinc.—Bafq Mining Co., Ltd. owned jointly by Rio Tinto-Zinc Corp., Ltd. (51 percent), and Société Minière et Métallurgipue de Penarroya, S.A. (49 percent), completed underground development and preparation of the Bafq mine. Mechanical difficulties were experienced in starting up the treatment plant, but at yearend 1968 work was in progress to overcome the problem.[9]

The Bafq mine, located southeast of Yazd, will be Iran's largest lead-zinc mine, with output set at about 50,000 tons per year of concentrates; zinc will account for 60 percent of the total. Probable ore reserves were set at 5.4 million tons with a combined lead and zinc content of 13 percent. Concentrates will be trucked more than 300 miles over mountainous terrain to Bandar Abbas and shipped to the United Kingdom and France.[10]

Sogemiran, S.A., completed its mine and concentrator in July 1968 near Delijan. During the year 103,000 cubic meters of ore were produced and run to the plant. After the start-up period, the concentrator reached an output of 1,400 tons daily of lead concentrate and 400 tons daily of barite.

NONMETALS

Cement.—The Fars and Khuzistan Cement Compny of Iran, the largest cement company in Iran, plans to build the country's largest privately owned cement plant. The new plant will produce approximately 1 million tons annually (3,000 tons per

[8] Mining Journal (London). V. 272, No. 6972, Apr. 4, 1969, p. 275.
[9] The Rio Tinto-Zinc Corporation Limited. Annual Report and Accounts. 1968, p. 45.
[10] Metals Week. V. 39, No. 36, Aug. 2, 1968, p. 8.

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day) and is expected to cost $23 million. The plant which is to be located at Qazvin, 90 miles west of Tehran, will utilize the "dry process."

MINERAL FUELS

Petroleum.—The Consortium (Iranian Oil Exploration and Producing Company and the Iranian Oil Refining Company) continues as the major petroleum company in Iran. Of growing importance is the Government corporation, National Iranian Oil Company (NIOC), which now has substantial production in participation with other companies, a new refinery, diversified operations to include natural gas sales to the U.S.S.R., and part ownership of a new steel pipe rolling mill. Companies which have joint ownership of petroleum production with NIOC are IPAC (Iran Pan-American Oil Company), SIRIP (Société Irano-Italiène des Petroles) and LAPCO (Lavan Petroleum Company).

Consortium.—Exploration drilling activities by the Consortium in 1968 led to the discovery of oil at Maleh-Kuh, Lab-e Sefid, and Shadegan. The former field is northwest of the major producing fields in south Iran, near the NIOC Ahwaz-Tehran pipeline. The oil has especially good characteristics with a gravity of 43° API and a sulfur content of only 0.6 percent.

Consortium production in 1968 was 989,665,000 barrels, up 10 percent from that during 1967. Agha Jari and Gach Saran continued as the major fields in Iran; however, their shares of Consortium production in 1968 declined to 33 and 21 percent, respectively. Other major fields were Marun, 16 percent (up from 7 percent in 1967); Biki Hakimeh, 11 percent, and Ahwaz, 8 percent. The remaining 10 fields accounted for 11 percent of production.

A major facility under construction by the Consortium at yearend 1968 was a natural gas liquids fractionation plant at Bandar Mah Shahr. In the first of a two-stage, $50 million project, the plant will have the daily capacity to produce 14,000 barrels of propane, 15,000 barrels of butane, and 19,000 barrels of naphtha. The liquefied petroleum gases will be exported. Feedstock will be a natural gas liquids mix from the five natural gas processing plants now under construction by the Consortium, three in Agha Jari oilfield and two in Marun oilfield. Each of the process plants will be able to process about 200 million cubic feet of gas per day. The dry gas will be delivered to the Bid Boland treatment plant of the National Iranian Gas Co., for distribution in Iran and export to the U.S.S.R.

The 50-mile, 42-inch parallel line from Agha Jari oilfield to Caneveh, a part of the Cham project, was commissioned in June 1968 and the Gurreh pump station was put in operation. Completion of this line and pump station added considerably to the ability to deliver crude to Kharg Island terminal.[11]

NIOC.—During 1968 the Iranian Government company drilled nine exploration wells and found gasfields at Tang-e Bijar in the western part of the country with an estimated reserve of 3 trillion cubic feet and at Khangiran in northeastern Khorassan (near Sarakhs) reportedly with reserves estimated at 18 trillion cubic feet. Plans are to pipe gas from the latter field to Mashhad.

The 85,000-barrel-per-day Tehran refinery of NIOC was completed early in the year and placed on stream. During the year it processed nearly 20 million barrels; about one-half of the output was residual fuel oil. Plans are to build a 2,000-barrel-per-day lubricating oil plant at the refinery. A modernization program was started during the year at the Kermanshah refinery. The $12 million project will increase throughput capacity to 16,000 barrels daily. Involved is the installation of a unifiner, a platformer, and a liquefied petroleum gas recovery unit. The work is expected to take 2 years. A new 40,000-barrel-per-day refinery is planned for Shiraz by 1971, to operate on Gach Saran crude. NIOC also plans a refinery for Tabriz; size and completion date have not been determined.

Production from Naft-e Shah field, the only field NIOC operated independent of other interests, totaled 3,423,000 barrels daily, up 5 percent from the 1967 level.

Société Francaise des Petroles d'Iran (Sofiran) a wholly owned subsidiary of the French Government company, Entreprise de Recherches d'Activitiés Pétrolières (ERAP), made a promising oil discovery during 1968 in the offshore part of the service contract area it has with NIOC. The well, located near Sirri Island in the middle of the lower part of the Persian

[11] Iranian Oil Operating Companies. Annual Review. 1968, pp. 19–20.

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Gulf in 234 feet of water, yielded a medium gravity oil at about 4,000 barrels daily. Since the well is located near the median line, development could be delayed.

IPAC.—Production in 1968 from Darius and Cyrus fields totaled 37.5 million barrels, an increase of only 2.4 percent over that of 1967. During the year IPAC concentrated on exploring new sections of its agreement area and in developing known fields. A field (name unknown) was discovered during 1968 west of Kharg Island. In addition IPAC has two other fields, Esfandiar and Feriedoon; however, both are at or near the Persian Gulf median line and development has been hindered pending a boundary settlement. In late 1968, an agreement was reached between Saudi Arabia and Iran on the demarcation of this line. Full-scale development drilling in both fields is expected in 1969.

SIRIP.—Production in 1968 from the offshore Bahrgan Sar field, which declined 12 percent during the year, totaled 6.6 million barrels. This is the fourth year of a general decline in Bahrgan Sar production. SIRIP, however, at yearend was building a 60-mile pipeline from its offshore Nowruz field to coastal facilities preparatory to putting the field in production in 1969. Other fields of unknown potential include Hendijan, 5 miles north of Bahrgan Sar and both Kuh-e Rig and Dudrou in the Zagros Mountains nearly 100 miles over rugged terrain from the Persian Gulf.

LAPCO.—This company is owned by NIOC (50 percent) and by subsidiaries of the following four U.S. companies each with 12.5-percent ownership. Atlantic Richfield Co., Murphy Oil Corp., Sun Oil Co., and Union Oil Co. of California.

With the commencement of production from Sassan field in 1968, this company is the latest to join a growing list of producing companies in Iran. Production in 1968, including small quantities in stock from experimental production in 1967, amounted to 2.4 million barrels.

Since 1965, LAPCO has expended $84 million in exploration activities, drilling 16 development wells, and building production, transportation, storage, and export facilities. The loading facilities, which were inaugurated in November 1968, can accommodate 200,000-deadweight-ton tankers. Exploration during 1968 also found oil in the "W" structure 60 miles southwest of Lavan Island.

IMINOCO.—Iranian Marine International Oil Company (IMINOCO) found its first oilfield (Rostam) in Iran's Persian Gulf area in 1968. IMINOCO is owned by NIOC (50 percent) and by subsidiaries of the three following organizations each with equal ownership: Phillips Petroleum Co., Ente Nazionale Idrocarburi (the Italian State Oil Company), and the Indian Oil and Natural Gas Commission.

In March 1968 the offshore Rostam field was declared producible. By the following October six wells had been drilled and completed as producers from two drilling platforms; the 18-inch, 68-mile line to Lavan Island was 90 percent complete and the storage and loading facilities were 75 percent complete. Production is expected to begin in July 1969 at a rate of 40,000 to 50,000 barrels per day.

Other Companies.—Persian Gulf Petroleum Co. (PEGUPCO), composed of seven West German companies, is believed to have continued exploration drilling in its 1,988-square-mile offshore concession area. Two exploration wells were abandoned in 1967. The remaining three companies with offshore exploration rights in 1968 had essentially terminated activities following unsatisfactory exploratory efforts since 1964.

Natural Gas.—Iran remained fourth in the world and first in the Middle East in natural gas reserves, estimated at 100 trillion cubic feet at the end of 1968. Because natural gas consumption as a percentage of production has been falling in recent year and because of the large waste of this natural resource, the Iranian Government is now implementing a program for substantially increasing consumption.

A major project in this program is the 1966 barter agreement between the Governments of Iran and the U.S.S.R. calling for the 15-year delivery of Iranian natural gas to the U.S.S.R. Gas will be supplied via a 1,120-kilometer, 40/42-inch trunkline from oilfields in the south to the frontier at Astara (on the western shore of the Caspian Sea). Construction on the line began in September 1967 and is to be completed by 1970. In addition to the main line there will be 184 kilometers of gathering and collection lines including a 68-kilometer line from NIOC's Sarajeh gasfield south of Tehran to Kuh-e Namak near Saveh. An additional 523 kilometers

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of distribution spur lines in Iran will supply gas to Tehran, Kashan, Isfahan, and Shiraz. There will be 10 compressing stations, five of which will be installed by 1970. The entire system called Iran Gas Trunkline (IGAT) is the biggest gas pipeline in the Middle East and is being undertaken by the National Iranian Gas Co., a Government corporation. Engineering and advisory services are being provided by Iranian Management and Engineering Group (IMEG) a British consulting firm. By the end of 1968, 316 kilometers of line had been completed south of the Zagros Mountains and 209 miles north of the mountains.

Main supply will be dry gas piped to Bid Boland from processing plants in Agha Jari and Marun oilfields. The Bid Boland treatment plant and compression station near Agha Jari field will remove and recover sulfur compounds from the gas. Initially the plant will have five trains of treating columns, each processing 240 million cubic feet per day. The recovery unit will have an ultimate capacity of 70 tons of elemental sulfur per day. Gas deliveries will average 1,060 British thermal units per cubic foot and the hydrogen sulfide will not exceed 0.25 grain per 100 cubic feet.

Scheduled deliveries to the U.S.S.R. will reach a maximum of 1,050 million cubic feet per day by 1975, while deliveries to Iranian users are to reach 579 million cubic feet per day by 1979.[12]

Construction continued during 1968 on the three petrochemical plants being built by joint ventures involving the National Petrochemical Co., a wholly owned subsidiary of NIOC. Each plant will use natural gas or refinery gas as feedstock. Based on the latest estimates the total investment in the projects will be $309 million.

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[12] Natural Gas and L.P.G. V. 1, No. 4, June 1968, pp. 22–23, 33. Pipeline Industry. V. 30, No. 3, March 1969, p. 61–65.

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The Mineral Industry of Iraq

By Edgar J. Gealy [1] and Agnes J. Doughman [2]

In 1968 the Iraq economy continued to be dominated by the production and export of petroleum. According to budget estimates, oil revenue was to provide just under half of the Government revenue, compared with slightly over half in 1967 (based on preliminary data). Other forms of taxes and extra budgetary revenue no doubt were stimulated, in part, by petroleum activities. In spite of the heavy contribution of petroleum to total revenues, the Government has been running a deficit in its account, part of which has been made up by foreign borrowing. It is against this background of government deficits that Iraq has been attempting to expand its national development program. Of the funding of the 5-year development program ending in 1970, over 70 percent was to have been provided by petroleum activities. Closures of export routes for Iraqi oil in 1967 because of an Iraqi-Syria dispute and the subsequent Arab-Israeli conflict, seriously reduced oil production and revenue and disrupted the Iraq financial program.

In 1968, oil export routes including the pipelines through Syria to the Mediterranean, operated at virtual capacity. Exports of crude oil in 1968 reached 524.8 million barrels, almost 24 percent higher than the 424.6 million barrels in 1967 and 14 percent higher than the 491.7 million barrels in 1966. As a result of the increased petroleum export, revenue to the Iraq Government in 1968 amounted to about $487 million compared with $369 million in 1967.

On July 17, 1968, a group of Iraqi army officers carried out a coup d'etat and ended the regime of President 'Abd al-Rohman and Premier Tahir Yahya. The new regime (the Revolutionary Command Council) appointed a new president, Ahmad Hasan al-Bakir and a new cabinet headed by Prime Minister 'Abd al-Razzag al-Naif. All those persons in the Government who had been principally responsible for Iraqi oil policy were arrested and it seemed obvious that there would be some significant changes in the future. By yearend, however, it began to appear that the new government was continuing the policies of the old by eliminating the possibility of returning the North Rumaila oilfield to the Iraq Petroleum Company (IPC) group concession, by honoring the contract between Iraq National Oil Company (INOC) and the French Enterprise de Recherches et d'Activities Petrolieres (ERAP), and by furthering the decision of INOC to engage in direct exploitation of the North Rumaila field.

Toward the end of 1968, the new government, through the Oil Minister, advised IPC not to try to circumvent Law No. 80 under which the Government took over all IPC acreage except that in production in 1961. Somewhat earlier, INOC had asked 13 companies (none from the United Kingdom or the United States) for tenders to develop the North Rumaila field with payment to be primarily in petroleum. These actions appeared to have ended any possibilities for the old agreement between IPC and the Government for the return of North Rumaila to the IPC concession; this agreement had never been ratified by the Government.

The envisioned development of North Rumaila calls for pipelines to link up with IPC's pipeline system to the Mediterranean. As IPC owned the existing but unused oil terminal at Fao and was already operating its pipeline system in the north at capacity, it was implied that the Iraqi Government and IPC may be negotiating on the use or disposition of these facilities in the future.

In nonfuel minerals, the new Government again followed a policy of the preced-

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[2] Statistical assistant, Division of International Activities.

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ing regime and toward the end of 1968 established the Iraqi National Minerals Company. This company was to take on the responsibility for the exploration, production and marketing of minerals (excluding petroleum). The Government also announced a 10-year program for an overall geological survey of the country in addition to specific mineral surveys.

PRODUCTION

Crude oil output in Iraq reached a new high of 550 million barrels in 1968, an increase of 9 percent over the previous high of 505 million barrels in 1966. Iraq's crude oil production was 4 percent of the total world output and 12 percent of the Middle East output. Virtually all of the increase came from the IPC companies and, although firm data were not available, it appeared that the very small output from the Government operated fields at Naft Khaneh and Quayara, for local consumption did not change significantly.

Table 1.—Iraq: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS					
Cement---thousand tons	1,092	r 1,296	r 1,279	r e 1,400	e 1,400
Gypsum e---do	500	500	500	500	500
Salt	27	r 38	r 37	r 41	e 40
MINERAL FUELS AND RELATED MATERIALS					
Gas: Natural, marketed---million cubic feet	13,500	12,900	21,419	r 18,191	27,293
Petroleum:					
Crude---thousand 42-gallon barrels	461,961	482,461	505,428	445,821	1 550,098
Refinery products:					
Gasoline---do	2,586	2,703	2,699	r 2,935	e 3,199
Kerosine and jet fuel---do	3,958	4,049	3,697	r 4,554	e 4,962
Distillate fuel oils---do	3,943	4,472	5,326	r 5,226	e 5,691
Residual fuel oils---do	7,732	8,565	5,691	r 7,475	e 8,161
Liquefied petroleum gas---do	48	e 60	e 60	e 60	e 60
Lubricants and other---do	618	544	e 550	r 172	r 188
Asphalt and bitumen, refinery---do	180	79	467	r 552	e 612
Total---do	19,065	20,472	18,490	20,974	22,873
Refinery fuel and loss---do	1,595	e 722	e 1,035	e 588	e 646

e Estimate. r Revised.
1 May include small quantity from government operated fields.

TRADE

Trade data for Iraq are not available. However, 24 developed nations reporting to the United Nations indicate that the following commodities, in the accompanying table, were imported by Iraq in 1966:

In addition, Iraq received 53,500 tons of iron and steel pipe and rolled products, and 1,000 tons nonferrous rolled products from the U.S.S.R.

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Commodity	Metric tons
METALS	
Aluminum, metal, including alloys	1,155
Copper, metal, including alloys:	
Unwrought	17
Semimanufactures	810
Iron and steel:	
Roasted pyrite	10,630
Semimanufactures	180,110
Lead, metal, including alloys:	
Unwrought	117
Semimanufactures	437
Tin, metal, including alloys, unwrought	28
Zinc, metal, including alloys, unwrought	116
NONMETALS	
Abrasives, grinding and polishing wheels and stones	126
Asbestos, crude	235
Cement	8,917
Fertilizer materials, manufactured	15,095
Sulfur, elemental	526
MINERAL FUELS AND RELATED MATERIALS	
Asphalt and bitumen, natural	3,312
Petroleum products—42-gallon barrels	48,000

Crude oil exports in 1966 were 491.7 million barrels. Of the known destinations, the United Kingdom and France each took 16 percent, Italy 13 percent, Japan 7 percent, and West Germany 6 percent; the United States received only 2 percent.

The dominant commodity in Iraq's trade is oil, which supplies about 90 percent of the export trade. Total commodity trade is shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	829	882
1966	873	939
1967	• 777	835
Imports:		
1965	37	451
1966	• 40	493
1967	• 35	423

• Estimate.

Crude oil exports in 1968 reached a high of 524.8 million barrels compared with 424.6 million barrels in 1967. The export shares of the three companies in the IPC complex shifted considerably from 1967 reflecting the full use of the pipelines to the Mediterranean during 1968; IPC (the operating company) increased its export share to 75 percent from 63 percent while the Basrah Petroleum Company, an IPC affiliate, dropped to 23 percent from 35 percent. The share of the remaining IPC affiliate, Mosul Petroleum Company, remained at 2 percent in 1968.

COMMODITY REVIEW

NONMETALS

Fertilizer Materials.—Iraq's first chemical fertilizer plant under construction at Abu al-Khusaib, near Basrah, will be completed in 1970. It will use natural gas from the Rumaila oilfield and sulfur from the Kirkuk sulfur recovery plant. Annual output is expected to be 66,000 tons of ammonia, 110,000 tons of sulfuric acid, 140,000 tons of ammonium sulfate, and 56,000 tons of urea. The possibility of exploiting Iraq's phosphate deposits was being studied during the year.

Sulfur.—After much negotiating, it is reported that early in 1969 the Iraqi Government concluded an agreement with an unnamed Polish sulfur firm to develop the Mishraq sulfur deposits. The Polish firm was to provide operational and marketing assistance under contract to the newly formed Iraqi National Minerals Company. Reserves at the high-grade sulfur deposit are estimated to be capable of sustaining a minimum annual production of 1 million tons. According to Iraqi reports an initial investment of about $23 million would be required to maintain this production rate. Information was not available regarding Polish financial participation.

The Iraqi owned sulfur recovery plant at Kirkuk started production in November 1968. Using 2.3 million cubic meters of associated gas daily from the Kirkuk field, it is expected to have an annual output of 120,000 tons of sulfur, 511,000 tons of dry gas, and 385,000 tons liquefied petroleum gas (LPG). Dual pipelines transport the gas to Baghdad for both domestic and industrial consumption.

MINERAL FUELS

Natural Gas.—A contract was awarded in March 1968 by the Iraqi and Turkish Governments to the French subsidiary of the U.S. Bechtel Corp., a construction and engineering firm, for a technical and economic study of the projected natural gas pipeline from Mosul in northern Iraq to Istanbul, Turkey. Total length of the pipe-

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line would be 2,000 kilometers with only 250 kilometers in Iraq. The Turkish Government is reportedly considering a loan to Iraq, to be repaid in 12 annual installments to finance the cost of the section on Iraqi territory. Even if the project is approved, gas deliveries at an initial rate of 8.5 million cubic meters daily would not be possible before 1971. Apart from difficulties that will be encountered in the mountainous terrain between the countries, a further problem may be the quantity of gas available from northern oilfields. The Kirkuk field is believed to be nearing its maximum rate of oil output and prospects for increased gas output are rather dim. At present Iraq's northern oilfields are producing associated gas at the rate of 6.5 million cubic meters daily. Domestic gas consumption will increase since 2 to 3 million cubic meters daily will be needed for processing at the Kirkuk sulfur recovery plant. However, Iraq has three nonassociated gasfields—Chemchemal, Kormor, and Khamugah—discovered by IPC prior to 1960 but so far each field has only one well completed.

Reserves of natural gas at the end of 1967 were an estimated 595 billion cubic meters.

Petroleum.—Iraq's reported crude oil reserves at the end of 1968 were 35 billion barrels or about 7 percent of the total proved and probable world reserves. Crude production averaged 1,503,000 barrels daily in 1968, an increase of 23 percent over that of 1967. The increased output came entirely from the northern fields where production is transported by IPC's pipelines to eastern Mediterranean terminals for export.

The French oil company, Entreprise de Recherches et d'Activities Petrolieres (ERAP), is reported to have encountered oil in its first wildcat in Iraq. It is the first time a French company has drilled in the country and the first test in the Fao structure. At yearend unconfirmed reports indicated the well, Siba No. 1, was yielding some 5,000 to 6,000 barrels daily. It is located in the onshore portion of Block 4 of the 4,170 square miles contracted to ERAP by Iraq National Oil Co. (INOC) in February 1968.

Under terms of the agreement ERAP acts only as a general contractor to INOC. After 3 years 50 percent of the area returns to the state. A further 25-percent reduction will occur at the end of 5 years, and after 6 years only proven areas are to be retained by ERAP. The exploration phases of the project are to be financed by ERAP and in the event of commercial production will be considered an interest-free loan to INOC repayable at one-fifteenth of the total each year or 10 cents per barrel, whichever is greater. Also with commercial production ERAP is to pay INOC a $2 million bonus and the same amount every 2 years until after 10 years when $5 million is to be paid for a total of $15 million. The contract extends for 20 years from date of commercial production. Finances for development and all facilities may be advanced by ERAP repayable by INOC as loans bearing a maximum 6-percent interest. ERAP will have the right to purchase 30 percent of crude production. The first 41 percent of ERAP purchases will be at a price determined as unit production cost (defined as amortization of production expenditure over 10 years) plus 13.5 percent of the posted price as a royalty. The remaining 59 percent of ERAP purchases will be at a price consisting of the above plus a lump sum payment of half of the difference of the above and the posted price. When production reaches 75,000 barrels daily for 90 consecutive days, INOC will set aside half of the recoverable oil as a national reserve.

INOC may request ERAP's assistance in marketing up to 200,000 barrels per day of INOC's share of production. As compensation ERAP will receive $0.05 per barrel on the first 100,000 barrels per day and $0.015 per barrel for the remaining 100,000 barrels per day. Five years after commercial production begins and provided that development loans are fully repaid, INOC is to take over direct management of all operations, with the continuation of the cooperation of both parties in technical and managerial aspects.

The Iraq National Oil Company (INOC) announced its decision to develop the North Rumaila oilfield. This field was removed from the concession area of the Iraq Petroleum Companies group (IPC) under the disputed Law No. 80 of 1961. Late in 1968 it was reported that INOC had invited bids from 13 West European, Soviet Bloc, and Japanese companies on the preparation of the North Rumaila oilfield on a turn-key basis. Originally bids were to be submitted

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within 2 months but later the deadline was extended to April 1, 1969. The initial development phase estimated to cost $17 million is to provide for production and export of 100,000 barrels daily. This will involve opening six shut-in wells (drilled by IPC) construction of gathering lines and other facilities at the field, an 80-mile pipeline to the port at Fao, and necessary storage facilities.

At yearend no contract had been awarded for the 70,000-barrel-per-day refinery the Iraqi Government planned at Adu Fulus near Basrah to supply petroleum products to southern Iraq. Only two bids had been received, both from Japanese firms. It was reported that the deadline for bids had been extended. The projected refinery is scheduled for completion in 1971 at an estimated cost of $50 million.

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The Mineral Industry of Ireland

By Columbus R. Gentile[1]

The Irish economy continued to expand in 1968, registering the greatest gain since 1964. The main impetus was provided by the industrial sector which advanced about 11.7 percent in volume over 1967 levels. Foreign trade again reached a record level in 1968 as both imports and exports registered significant increases over those in 1967. A substantial import excess developed, however, as the value of imports (1968 Irish pound basis) rose 24.8 percent and exports increased only 16.6 percent. Based on dollar equivalent, reflecting the 14.3-percent devaluation of the Irish pound effective November 18, 1967, the increase for imports and exports was 9.3 percent and 2.3 percent, respectively. A rise of 4.8 percent in consumer prices and an increase of 8.7 percent in average industrial wages was offset to some extent by a 9.6-percent climb in labor productivity. The "Third Program for Economic and Social Development, 1969–72" released by the Government of Ireland in March 1969, projects continued further expansion of the national economy. A growth rate of 17 percent was indicated for the 4-year period with virtually all economic sectors expanding at an accelerated annual rate.

The extractive industries as a group achieved a 19-percent gain in 1968 as compared with 1967 production, attributed mainly to increased output of new metal mines and higher level of peat recovery made possible by better than normal weather conditions. Increased tonnages of metal ores were mined and processed as Ireland's third metal mine was activated. Development of several new properties was initiated during the year and mineral exploration activities continued at a rapid pace with several new groups entering the field. Plans for the construction of the first base-metal smelter in Ireland neared reality in 1968 with the formation of a new corporate group (Smelter Corporation of Ireland, Ltd.) headed by Northgate Exploration Ltd. Nonmetal mineral output was up sharply in 1968 owing to the high level of construction activity in the industrial sector and the strong demand for barite and other products in the export market.

Petroleum continued to dominate the mineral fuels sector accounting for an increasing share of the growing internal energy market. However the nation was still entirely dependent on foreign crude oil to meet refinery needs and also continued to import substantial quantities of selected refinery products. Drill tests for oil at several onshore concession areas proved negative during the year, resulting in a shift in exploration activities to offshore locations near the southwest coast of Ireland. Record output and use of peat was attained in 1968, but coal and coke production and consumption declined as petroleum continued to displace these solid fuels in select markets.

PRODUCTION

The year 1968 featured a notable increase in the mine output (metal content) of zinc (77 percent) and copper (84 percent), small increases for lead (3.3 percent), and a decline for silver (7.5 percent). Steel ingot production rose an estimated 3 percent. In the nonmetal sector impressive gains were made in the output of barite (88 percent), lime (50 percent), and sand and gravel (40 percent). Moderate though somewhat lesser increases

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were registered in production of cement (4.2 percent) and limestone (5.1 percent). The notable event in the mineral fuels sector was an increase of 41.6 percent in total output of sod and milled peat, which was attributed to favorable weather conditions for working the peat bogs. Offsetting this was a further decline in production of coal (down 8.8 percent) and gas coke (down 12 percent). Output of refined petroleum products (exclusive of gasoline and jet fuel) decreased in 1968 as refinery operations were interrupted for a short period because of labor problems.

Table 1.—Ireland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Copper, mine output, metal content—thousand tons	-------	-------	1	4	7
Lead, mine output, metal content—do	1	3	40	r 60	62
Silver, mine output, metal content—thousand troy ounces	-------	-------	1,218	2,067	1,913
Steel ingots and castings—thousand tons	53	66	r 54	65	e 67
Zinc, mine output, metal content—do	-------	1	25	30	53
NONMETALS					
Barite—do	41	84	125	76	143
Cement—do	1,036	1,239	1,113	1,298	1,352
Fertilizer: Superphosphate (P_2O_5 content)—do	71	r 76	r 73	83	NA
Gypsum—do	232	r 229	220	252	NA
Lime—do	43	42	41	42	63
Limestone [1]—do	3,150	3,558	4,359	4,820	5,064
Sand and gravel [1]—do	2,225	2,204	2,358	2,649	3,717
Other [2]—do	2,142	2,316	2,383	2,431	2,720
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—do	153	118	121	111	103
Semibituminous—do	77	66	54	71	63
Coke, gas plant, includes breeze—do	131	r 127	105	r 93	e 82
Gas, manufactured [3]—million cubic feet	6,427	6,497	6,538	6,568	6,583
Peat:					
Agricultural use—thousand tons	24	28	29	37	41
Fuel use:					
Briquets—do	296	256	230	309	250
Sod peat—do	2,481	2,209	2,177	2,230	2,248
Milled peat [4]—do	1,336	1,490	2,031	2,465	3,490
Petroleum refinery products:					
Gasoline and naphthas—thousand 42-gallon barrels	3,278	3,644	2,989	r 4,012	4,459
Jet fuel—do	-------	-------	-------	199	685
Distillate fuel oil—do	3,911	4,493	3,372	r 5,916	4,662
Residual fuel oil—do	5,076	5,930	4,175	r 7,178	6,181
Other salable products—do	277	471	253	r 952	418
Refinery fuel and losses—do	692	744	759	r 684	718

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Figures do not include large quantities of granite, stone, sand and gravel, and other materials produced by local authorities and road contractors for maintenance of roads.

[2] Includes granite, marble, silica rock-sand-clay, igenous rock, calcspar, fire clays, shale and clay for burning cement.

[3] Converted from standard cubic meters of 4,200 kilocalories to cubic feet using factor 1 cubic meter =35.3144 cubic feet.

[4] Includes milled peat for manufacture of briquets except 1964.

TRADE

The first full calendar year of foreign trade (1968) since devaluation of the Irish pound concurrently with the British pound in November 1967, reflects that the higher level of mineral commodity exports was inadequate to offset the impact of the 14.3-percent decline in value of the Irish pound. This adverse action was even more pronounced since imports of the same commodities in 1968 rose much more rapidly than exports contributing significantly to the unfavorable trade balance for the year.

Total mineral commodity imports of Ireland in 1968 amounted to $211.1 million or roughly 3.9 times the value of exports ($54.5 million). Compared with 1967 values, the dollar value of mineral imports rose 6.8 percent while exports fell about 2.2 percent. In both cases, however, the volume handled in 1968 was higher than

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in 1967. The dollar value of mineral commodity imports represented almost 18 percent of total imports in 1968, while exports of these commodities accounted for 7 percent of total exports, as indicated in the following tabulation:

	Value [1] (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:[2]		
1966 r	43.7	661.8
1967 r	55.7	759.0
1968 p	54.5	776.1
Imports:		
1966 r	178.5	1,043.2
1967 r	197.6	1,074.7
1968 p	211.1	1,174.8

r Revised. p Preliminary.
[1] Conversion basis of Irish pound as follows: 1966, $2.80; 1967, $2.75 approximate; 1968, $2.40.
[2] Excludes reexports.

Major mineral exports in 1967 on the basis of total mineral commodity export value, were metalliferous ore and scrap (31 percent), petroleum and products (26 percent), cement and building products (almost 11 percent), nonferrous metals (9 percent), and clays and refractory construction materials (7 percent). The export value of metalliferous ores and scrap ($17.4 million) was about 6 percent above the level for 1966; mineral fuels (predominantly petroleum products, lubricants, etc.) $17.5 million—more than three times the 1966 total; and exports of cement and building materials ($7.2 million), clays and refractory construction materials ($3.8 million), and crude fertilizers ($2.7 million) were up 5.9 percent, 18.8 percent, and 12.5 percent, respectively. Nonferrous metal exports valued at $5.1 million in 1967 were down 15 percent as compared with 1966 levels and exports of iron and steel ($1.7 million) were off some 41 percent.

Most of Ireland's export trade in mineral commodities in 1967 was with Western Europe (92.3 percent) with the United Kingdom by far the largest individual market (56 percent of the total), and Common Market (EEC) countries the second largest (almost 33 percent of the total). United States share of Ireland's mineral commodity exports (based on dollar value) was slightly over 4 percent.

On the import side, petroleum and petroleum products (40.8 percent) remained, by far, the most important category by value, with iron and steel (14.2 percent), coal and coal briquets (11.2 percent), nonferrous metals (10.4 percent), manufactured fertilizer (9.5 percent), and crude fertilizer and other minerals (8 percent), as lesser but still important categories. Imports of petroleum and petroleum products increased 24 percent to $80.7 million, manufactured fertilizer 41.4 percent to $18.8 million, and crude fertilizer and other

Table 2.—Ireland: Exports [1] of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum metal, including alloys:		
Scrap	1,352	670
Unwrought and semimanufactures	5,592	5,444
Copper metal, including alloys:		
Scrap	4,353	3,993
Unwrought and semimanufactures	1,577	1,086
Iron and steel:		
Scrap	18,640	32,039
Steel, primary forms	11,241	542
Semimanufactures	18,370	12,177
Lead:		
Ore and concentrate	NA	135,577
Metal, including alloys:		
Scrap	809	407
Unwrought and semimanufactures	259	606
Tin ore and concentrate long tons	49	NA
Zinc ore and concentrate	NA	34,449
Other ore and concentrate	NA	453
NONMETALS		
Barite and witherite	129,878	74,765
Cement thousand tons	287	358
Clay and clay products:		
Refractory (including nonclay bricks)	30,785	40,295
Nonrefractory	18,553	14,002
Fertilizer materials:		
Crude	15,299	NA
Manufactured	15,956	1,416
Gypsum and plasters thousand tons	103	113
Stone, sand and gravel:		
Dimension stone, crude and partly worked	144	NA
Gravel and crushed rock thousand tons	242	307
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets:		
Anthracite and bituminous coal	6,394	6,746
Coal and semicoke	31,258	23,401
Peat, including peat briquets	57,570	60,749
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	71	366
Distillate fuel oil do.	637	2,384
Residual fuel oil do.	84	2,212
Mineral tar and other coal, petroleum or gas derived chemicals	8,787	NA

NA Not available.
[1] Excludes reexports.

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select minerals 16.2 percent to $15.8 million. In contrast, imports of nonferrous metals valued at $20.5 million were down 10.9 percent and those of coal and coal briquets valued at $22.1 million declined 7.9 percent. Iron and steel imports at $28.1 million were virtually at the same level as for 1966.

Western Europe supplied 54.3 percent of Ireland's mineral commodities imports in 1967, with the United Kingdom (36.9 percent) and EEC countries (15.3 percent) as the principal suppliers. Outside Western Europe, other significant sources of imports (by dollar value) included Iraq (7.3 percent), Saudi Arabia (6.6 percent), and Iran (6.2 percent). The share provided by United States was 5.4 percent.

Table 3.—Ireland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum metal, including alloys:		
Unwrought	10,353	8,360
Semimanufactures	4,927	4,777
Copper metal, including alloys:		
Unwrought	158	148
Semimanufactures	7,146	6,353
Iron and steel:		
Ore and concentrate	724	NA
Metal:		
Pig iron, ferroalloys and similar materials	21,244	28,592
Steel, primary forms	52,298	NA
Semimanufactures:		
Wire rod	16,813	18,270
Other bars and rods	14,107	13,857
Universals, plates and sheets	70,963	64,771
Hoop and strip	4,572	6,264
Rails and accessories	6,081	4,693
Wire	4,695	4,718
Tubes, pipes, fittings	25,659	31,557
Castings and forgings, rough	178	116
Lead:		
Oxides	1,373	1,449
Metal, including alloys, all forms	436	421
Nickel metal, including alloys, all forms	115	303
Platinum-group metals and silver, metal including alloys; Silver, all forms—value, thousands	$289	$294
Tin metal, including alloys, all forms—long tons	62	93
Titanium oxide	1,778	2,451
Zinc:		
Oxides	805	477
Metal, including alloys:		
Unwrought	3,147	3,661
Semimanufactures	203	260
Ore and concentrate	17,914	14,160
Ash and residues containing nonferrous metals	540	NA
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	243	258
Asbestos	6,034	4,751
Cement—thousand tons	9	9
Clay and clay products (including all refractory brick):		
Crude clays, n.e.s	28,351	30,686
Products:		
Refractory (including nonclay bricks)	10,836	10,679
Nonrefractory	4,771	5,094
NONMETALS—Continued		
Fertilizer materials:		
Crude:		
Nitrogenous—thousand tons	1	1
Phosphatic—do	259	358
Manufactured:		
Nitrogenous—do	26	36
Phosphatic:		
Thomas slag—do	90	117
Other—do	9	12
Potassic—do	160	198
Other, including mixed—thousand tons	26	84
Ammonia	4,226	15,540
Lime	3,699	4,126
Pigments, mineral, including processed iron oxides	1,256	1,342
Pyrite (gross weight)	1,981	1,930
Salt—thousand tons	44	47
Sodium and potassium compounds, n.e.s.:		
Caustic soda	4,415	4,665
Caustic potash, sodic and potassic hydroxides	244	NA
Stone, sand and gravel:		
Dimension stone:		
Crude and partly worked	2,814	3,010
Worked	504	396
Gravel and crushed rock	27,834	9,770
Sand, excluding metal bearing	38,820	31,925
Sulfur:		
Elemental	86,657	99,422
Sulfuric acid	1,289	1,577
Other nonmetals, n.e.s	3,804	9,645
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	794	589
Coal and briquets:		
Anthracite and bituminous—thousand tons	1,332	1,258
Briquets of anthracite and bituminous coal	5	8
Coke and semicoke	15	17
Gas, hydrocarbon, natural	16,353	9,833
Petroleum:		
Crude and partly refined—thousand 42-gallon barrels	11,693	18,785
Refinery products:		
Gasoline—do	975	564
Kerosine and jet fuel—thousand tons	1,813	1,875
Distillate fuel oil—do	661	344
Residual fuel oil—do	4,283	5,026
Lubricants	180	322
Mineral jelly and wax	2,918	2,424
Mineral tar and other coal, petroleum, or gas derived crude chemicals	9,668	11,137

NA Not available.

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COMMODITY REVIEW

METALS

Copper, Lead, Zinc, and Silver.—Production of metal ores continued at a high level in 1968 along with exploration and drilling of new sites, several of which indicated a potential for commercial exploitation of metal-bearing ores. Notable developments in 1968 included the opening of a new zinc-lead-silver mine, the third to be activitated in Ireland in the past 3 years; plans to reactivate the Avoca copper mine which was shut down in 1962; the formation of a corporate group (Smelter Corporation of Ireland, Ltd.), with controlling interest held by Northgate Exploration Ltd., to plan the construction of a base-metal smelter in Ireland; and the discovery of mercury in commercial quantities in ores mined by Gortdrum Mines.

Late in May 1968 limited operations were initiated at the new lead-zinc-silver mine, Silvermines, opened by Mogul of Ireland (a 75-percent-owned subsidiary of International Mogul Limited). The mine, officially dedicated in September, is expected to produce 1 million tons of ore per year which will be processed at the 3,000-ton-per-day mill. In contrast to the Tynagh and Gortdrum surface mines, Mogul's operation is underground with ore recovered at a depth of 900 feet. Annual outputs of zinc and lead (metal content of ore) are expected to be 56,000 tons and 16,000 tons, respectively.

Gortdrum's copper-silver mine in County Tipperary completed its first full year of operation in 1968, but performed at below capacity level during the first 4 months owing to operational difficulties. Metal content of copper and silver in ore mined amounted to 4,800 metric tons and 397,000 troy ounces, respectively. A substantial portion of the concentrates produced in 1968 were stockpiled and are to be processed for recovery of mercury at the company's new $1.5 million extraction plant scheduled to be completed in 1969. Construction of the plant was initiated following investigations that indicated significant quantities of mercury were contained in concentrates produced, and in certain stockpiled low-grade ore, as well as in the upper benches of ore deposits occurring in several areas. Elsewhere in Ireland, Gortdrum Mines continued drilling activity in the vicinity of Moate, County Westmeath, about 35 miles northwest of the Tynagh mine. Initial drilling indicated a relatively horizontal lead-zinc ore deposit about 100 feet below the surface. Economic feasibility for commercial exploitation depends on results of more extensive drill tests to be completed in 1969. At yearend 1968, the company held or had applied for 55 prospecting licenses mostly in central Ireland in Counties Westmeath and Offaly.

The possibility that a base metal smelter would be built in Ireland neared realization in 1968 when a new corporate group, Smelter Corporation of Ireland, was established to work toward this objective. Northgate Exploration Ltd., the principal stockholder (51 percent), is actively engaged in several mining enterprises in Ireland, operating through wholly owned subsidiaries such as Irish Base Metals Ltd., or as an important stockholder, either directly or through associated companies, in several other groups including Gortdrum Mines Ltd., and the recently constituted Avoca Mines (Canada) Ltd.

Irish Base Metals Ltd. operates the Tynagh mine, the main producer of nonferrous metals in Western Europe. Operation at this mine continued at a high level in 1968 despite two shutdowns both of short duration. Production (metal contained in concentrates) included lead, 58,700 metric tons; zinc, 31,300 tons; copper, 2,300 tons; and silver, 1.5 million ounces. By yearend considerable progress had been made on the 3,300-foot incline tunnel being constructed to reach the primary sulfide ore underlying the open-pit section now being worked. Underground mining is scheduled to begin in 1971. Meanwhile drill testing of extensions of Tynagh mine deposits is continuing and exploration programs are underway at several locations in Galway, Donegal, and Mayo Counties. At yearend, the 75 prospecting licenses held by Northgate Exploration and associated companies and the 29 applied for, covered a combined area of 1,300 square miles.

Action was initiated early in 1969 to reactivate the Avoca copper mine and 4,000-ton-per-day flotation mill which were closed in 1962 because of high costs of production. A new corporate group, Avoca Mines (Canada) Ltd. has acquired rights to the property. Discovery Mines Ltd. of Canada will have a 50-percent interest with the balance shared by two Northgate groups (Tara Exploration and Development Co. Ltd. and Gortdrum Mines Ltd.),

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Superior Oil Co. and Patino Mining Corp. Approximately $4.5 million is to be spent to reactivate the mine with planned initial daily ore production at the rate of 2,000 to 3,000 tons. Reserves of copper-pyrite ore, grading about 1 percent copper, have been estimated at 6 million tons.

In addition to mining and exploration work at properties of the above-mentioned companies, investigations or studies of other areas in Ireland are underway, such as the Rio Tinto-Zinc (RTZ) project at Keel in County Longford where results of core samples justified the sinking of a 600-foot shaft, and the Dennison Mines property near Aherlow, about 15 miles south of Tipperary, where initial drilling indicated a copper-silver deposit with estimated reserves of 6 million tons. Prospecting is also in progress at three other Dennison sites. Cerro Corporation and Guggenheim Exploration Company, both of New York, have signed agreements with several subsidiaries of Northgate Exploration Ltd. for exploration rights on select properties held by these companies in the Waterford area.

Magnesium.—A subsidiary of Pfizer group, Quigley Company Incorporated and associates, announced plans to build a 75,000-ton-per-year sea-water magnesia plant at Ballynacourty Point, near Waterford, on the southern coast of Ireland. Estimated cost of the plant, to be completed in 1969, is placed at $6.5 million. Dolomite required for the operation will be mined from quarries near Bennetsbridge in County Kilkenney.

NONMETALS

Barite.—Output of barite reached a record high of 143,000 metric tons in 1968, up 88 percent from the output in 1967, an abnormal year. The main stimulus was provided by rising demand in foreign markets, mainly United States. Production at present is predominantly from open-cast workings at Ballynoe, operated by Magnet Cove Barium Limited of Ireland (Magcobar), a subsidiary of Dresser A.G., Zurich. The deposit, one of the finest concentrations of barite in the world, varies in thickness from 10 to 60 feet and dips at a modest 18°. No washing or beneficiation of the ore is necessary.

At the Tynagh lead-copper-zinc-silver mine of Irish Base Minerals Ltd., a pilot plant for recovery of barite as well as lead, copper, and silver from tailings began operation in November 1968.

Building Materials.—The sharp rise in output of cement, sand and gravel, lime, and limestone in 1968 stems from the higher level of building and construction activity, particularly in the industrial sector, and increased demand in the export market.

MINERAL FUELS

Petroleum fuels continued to dominate the energy sector in 1968, providing an increasing share of the nation's growing energy needs. Meanwhile, government efforts were directed to maximum exploitation and utilization of indigenous peat resources and the remaining undeveloped hydropower potential. Coal continued to decline in importance in 1968 owing to inroads on markets by liquid fuels. Indigenous coal is poor in quality and expensive to mine and imported coal is costly relative to prices of competitive fuels.

In 1968 consumption of refined petroleum products rose 11.8 percent to 3.1 million tons, imports of crude oil (2.4 million tons) were down about 9 percent, and imports of major refined products at 1 million tons were roughly at the same level as for the previous year. Exports of petroleum fuels (mostly residual and distillate fuel oils) were down sharply to 350,000 tons. No crude oil is produced in Ireland, requirements for the nation's lone refinery, Whitegate (annual capacity 2.5 million tons), are met entirely from imports obtained largely from Middle East suppliers and Libya.

Oil exploration activities of Marathon Petroleum Ireland, a subsidiary of Marathon Oil Company United States, were discontinued at onshore concession areas near Leitrim and Cavan following the drilling of six dry holes. Company efforts are now being directed to leased offshore locations near the west and south coasts of Ireland. By yearend no action had been taken by government officials with respect to applications for exploration permits submitted by several other corporate groups.

The crude oil distribution terminal of Gulf Oil Corp., on Whiddy Island in Bantry Bay off the southwest coast of Ireland, became fully operational late in October when the first of six mammoth tankers (312,000 deadweight tons) to be

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built, arrived from the Middle East with 2,250,000 barrels of crude oil. The terminal, with storage capacity of about 1 million tons, was built to serve as a crude oil distribution center for company refineries located in coastal areas on the European continent and the United Kingdom where port facilities are inadequate to accommodate tankers much larger than 100,000 deadweight tons.

There was a sharp rise in production and use of peat fuel in 1968 as favorable weather conditions permitted more working time for the recovery of added tonnages, increasing the supply available for distribution. In contrast, coal production in 1968 declined 8.8 percent to 166,000 tons and imports at 1,201,000 tons were down about 3 percent, as liquid fuels continued to displace coal in select fuel markets, particularly at gasworks. Increased use of petroleum fuels in place of coal at gasworks was also the main factor in coke output declining 12 percent to an estimated 82,000 tons.

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The Mineral Industry of Israel

By Walter C. Woodmansee [1]

The Israeli mineral industry made further progress in 1968, which was a period of renewed prosperity and increased economic growth. The gross national product (GNP) reached the $4 billion [2] level for the first time. Total mineral industry contribution to this GNP was not reported, but principal mining sector export sales were valued as follows: Potash $13.5 million, cement copper $11.6 million, phosphate $6.9 million, and bromine $3.1 million.[3] In 1967, the latest year for which complete data were available, total mineral commodity exports (excluding a large part of the petroleum sector) were $236 million, about 6 percent of the GNP for that year. For 1968, data on the two most important commodities in terms of value—petroleum and diamond—were not available.

The most significant mineral industry developments were in the petroleum sector, where construction started on the 42-inch, 400,000-barrel-per-day pipeline from Eilat, the Red Sea port, to Ashkelon on the Mediterranean Sea. No final decision was made regarding the proposed new 100,000-barrel-per-day oil refinery at Ashdod. The Haifa refinery was undergoing a small expansion.

The mineral industry was expected to play a major role in establishing an integrated chemical industry. Israel Chemicals Ltd. (ICL), the new holding company established in 1967, made progress toward merging six member chemical and petroleum companies under one management. Research and development and construction operations of Dead Sea Works Ltd. and Chemicals and Phosphates Ltd., two member companies, have been merged under management of the same Board of Directors. A similar relationship exists between Haifa Refineries Ltd. and Israel Petrochemical Enterprises Ltd. It is hoped that coordinated management will improve efficiency and that ICL, when established as a fully operating company, will be able to compete with major international chemi-

[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from Israeli pounds (I£) to U.S. dollars at the rate of I£3.5=$1.00.

[3] U.S. Embassy, Tel Aviv, Annual Mineral Industries Report, Airgram A-295, May 10, 1969, 9 pp. This report provided substantial information for this chapter.

Table 1.—Israel: Salient statistics

	1965	1966	1967
Gross national product (current prices)--million dollars--	3,496	3,822	3,947
Index of industrial production (1958=100)	241.7	245.1	237.4
Index of mineral industry production [1] (1958=100)	314	331	313
Total labor force (average)[2]	641,700	638,900	620,600
Mineral industry labor force (average)[3]	178,600	173,100	164,500
Value total commodity exports--million dollars--	429	503	555
Value mineral commodity exports [4]--do--	201	r 236	236
Value total commodity imports--do--	r 832	r 835	768
Value mineral commodity imports [4]--do--	255	279	267

r Revised.

[1] Mining and quarrying only.

[2] Excludes domestic help and defense services.

[3] Mining, quarrying, and manufacturing.

[4] Includes those commodities listed in tables 3 and 4 of this chapter. Data are incomplete for exports from the petroleum sector.

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cal companies. Sales of the member firms were about $100 million in 1968. ICL management hopes to triple sales by 1975.[4]

Investment incentives were provided in the metal-working and chemical industries under the Law for the Encouragement of Capital Investment. Assistance was extended to existing and planned metal industries, both in the private and cooperative sectors. With production of basic chemicals and fertilizers expanding, the Government strongly encouraged the establishment of new plants for utilizing by-products of these basic industries.[5]

A United Nations Special Fund—Government of Israel 5-year, $12 million project will establish a Center for Industrial Research at Haifa. The United Nations will contribute $2 million to the project, the Israeli Government $10 million. The Center will include operations of Israel Mining Industries and the Institute for Research and Development, among other agencies. Completion of the project was scheduled for 1971.

PRODUCTION

Precise information is lacking for several mineral commodities during 1968. Output of beneficiated phosphate, potash, and marketed natural gas showed substantial gains. The potash and phosphate facilities were undergoing expansion during the year. New industry was connected to the natural gas pipeline network. Yields of crude petroleum from Israel's three small fields continued to decrease as established reserves were gradually being depleted. Receipts of crude oil from occupied Sinai Peninsula fields continued throughout the year, but output data from this source were not available. Haifa refinery production also was not available. The refinery reportedly operated at full capacity throughout the year. Output probably was slightly above the 1967 level.

[4] The Financial Times. Apr. 30, 1968, p. 28.
[5] International Commerce. V. 74, No. 49, Dec. 2, 1968, pp. 24–25.

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Table 2.—Israel: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Copper, cement, 70 to 80 percent Cu, gross weight	e 9,700	e 10,000	10,349	9,464	10,282
Iron and steel: Steel, ingots and semimanufactures—thousand tons	83	84	84	e 84	e 84
NONMETALS					
Bromine:					
Elemental	e 4,500	e 7,600	e 7,100	6,320	9,376
Compounds	NA	e 3,200	e 3,200	1,853	
Cement, hydraulic—thousand tons	1,098	1,260	1,168	805	e 1,200
Clays, marketed—do	e 30	39	41	111	e 100
Fertilizer materials:					
Crude:					
Phosphate, beneficiated—do	240	388	650	e 600	777
Potash:					
Gross weight—do	256	481	508	492	e 600
Potassium oxide (K_2O) equivalent—thousand tons	156	293	310	300	e 366
Manufactured:					
Nitrogenous	NA	95,453	92,668	e 95,000	e 95,000
Phosphatic	NA	107,114	110,598	132,264	e 130,000
Potassic	NA	3,889	732	1,260	e 1,000
Gypsum e—thousand tons	110	110	85	90	70
Lime e—do	110	130	75	80	80
Quartz, sand, marketed	e 40,000	r 39,905	32,438	35,292	e 35,000
Salt, mainly marine, marketed	e 43,000	54,790	57,637	57,084	e 73,000
Stone, sand, and gravel:					
Dimension stone: Marble—thousand cubic meters	7	7	6	6	15
Crushed and broken: Mainly limestone e—thousand cubic meters	2,000	1,500	1,200	1,200	2,000
Sand and gravel e—do	3,000	3,000	4,000	5,000	5,000
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, marketed—million cubic feet	1,069	2,705	3,562	3,859	4,238
Peat—thousand tons	14	15	20	e 20	e 20
Petroleum:					
Crude—thousand 42-gallon barrels	1,440	1,469	1,359	r 1 971	1 831
Refinery products:					
Gasoline—do	2,948	3,433	4,055	4,850	NA
Kerosine and jet fuel—do	2,333	1,729	2,017	4,958	NA
Distillate fuel oil—do	5,500	7,286	6,685	8,479	NA
Residual fuel oil—do	8,700	8,028	9,539	13,150	NA
Other—do	478	2,063	2,394	r 2,515	NA
Total—do	19,959	22,539	24,690	33,952	NA

e Estimate. r Revised. NA Not available.
1 Does not include Israeli production from occupied Sinai Peninsula oilfields.

TRADE

There were no major shifts in foreign trade for mineral commodities during 1967, the latest year for which complete data are available. Cut and polished gem diamond, potash, cement copper, and beneficiated phosphate remained the major mineral commodity exports; crude diamond, petroleum products, and iron and steel (mainly semimanufactures) were major mineral commodity imports. Worked diamond comprised about 82 percent of mineral exports by value, and 35 percent of total commodity exports, in 1967. Rough gem diamond comprised nearly 52 percent of mineral imports and 18 percent of total imports.

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Table 3.—Israel: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	1,914	1,855	Switzerland 469; Turkey 388; Italy 326.
Copper:			
Concentrate (cement copper)	10,106	13,636	Spain 7,795; Hungary 2,059; Greece 1,531; Japan 1,437.
Metal, including alloys, all forms	r 6,459	3,536	Spain 751; West Germany 570; Switzerland 478; United States 456.
Iron and steel: Metal:			
Scrap	1,071	1,465	West Germany 789; Japan 149; United States 143.
Steel, primary forms	-------	20	All to Belgium.
Semimanufactures	r 11,216	8,664	Bulgaria 2,429; Turkey 1,033; Iran 994; United States 803.
Lead, metal, including alloys, all forms	314	347	Belgium 155; Italy 144.
Nickel, metal, including alloys, all forms	2	11	West Germany 5; United Kingdom 3.
Tin, metal, including alloys, all forms	175	2	All to United Kingdom.
Zinc, metal, including alloys, all forms	r 703	313	Italy 126; Belgium 114; United Kingdom 50.
Other, metalloids, undifferentiated	-------	1,554	All to Spain.
NONMETALS			
Abrasive materials, grinding stone	r 7	5	All to Turkey.
Bromine and products	5,878	5,718	United Kingdom 1,772; Italy 906; Republic of South Africa 508.
Cement and clinker	r 177,463	251,536	Countries of Central America 93,104; Ghana 43,970; Ivory Coast 40,827; Italy 39,319.
Clay and clay products:			
Crude clays	3,692	2,230	Netherlands 1,479; Italy 327; Yugoslavia 311.
Products, refractory	r 4,157	2,821	Greece 2,118; Belgium 245.
Diamond, gem, not set or strung	thousand carats 1,450	1,449	United States 554; Hong Kong 160; Belgium 150; Netherlands 139.
Fertilizer materials:			
Crude:			
Phosphate	423,496	419,998	Yugoslavia 89,874; Turkey 70,711; Rumania 53,092; Japan 41,743.
Potash (61 percent K_2O)	r 378,172	454,631	Poland 104,105; United States 51,377; Japan 48,519; Italy 46,921.
Manufactured:			
Nitrogenous	1,500	504	Cyprus 500.
Phosphatic	1,500	1,320	Cyprus 1,120.
Other	-------	100	All to Brazil.
Ammonia	52	11	Greece 8.
Gypsum	850	200	All to Sierra Leone.
Lime	722	-------	
Precious and semiprecious stone, except diamond	value, thousands $261	$351	NA.
Salt	209	285	Malaysia 175; Kenya 110.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	249	495	Italy 400; Turkey 95.
Sulfur, elemental, all forms	-------	315	All to Rumania.
Other: Building materials of asbestos and cement	7,356	6,882	Kenya 2,527; Ghana 1,938; Ethiopia 1,078.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	362	2,603	Kenya 1,860; Ethiopia 517.
Carbon and carbon black	3,081	7,154	Hungary 2,550; United States 1,200.
Coal and products	-------	1	NA.
Petroleum:			
Crude and partly refined • r	thousand 42-gallon barrels -------	7,700	NA.
Refinery products: • r			
Gasoline	do 1,369	1,800	NA.
Kerosine	do 273	850	NA.
Jet fuel	do -------	675	NA.
Distillate fuel oil	do 2,441	3,350	NA.
Residual fuel oil	do -------	2,800	NA.
Other	do -------	1,010	NA.
Total	do 4,088	10,485	

• Estimate. r Revised. NA Not available.

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Table 4.—Israel: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967	Principal sources, 1967
METALS				
Aluminum:				
Oxide and hydroxide		481	697	France 544; West Germany 91.
Metal, including alloys, all forms		r 9,739	7,622	France 2,408; Switzerland 1,840; United States 1,171.
Cadmium, metal, including alloys, all forms		4	8	NA.
Copper:				
Matte		312	-------	
Metal, including alloys, all forms		r 8,952	7,015	United Kingdom 1,882; West Germany 1,275; Italy 1,086; Switzerland 923.
Gold, metal, unworked or partly worked.	troy ounces	27,135	198,884	West Germany 182,648; United Kingdom 15,915.
Iron and steel: Metal:				
Scrap		418	-------	
Pig iron, ferroalloys, and similar materials.		10,764	4,771	Finland 2,845; West Germany 675; Netherlands 477.
Steel, primary forms		r 47,404	35,906	West Germany 30,490; Hungary 3,585.
Semimanufactures		r 240,498	197,450	Italy 46,764; United Kingdom 35,750; West Germany 34,886; France 21,639.
Lead:				
Oxides		589	615	France 561.
Metal, including alloys, all forms		r 1,538	1,607	United Kingdom 708; Netherlands 437; Belgium 223.
Magnesium, metal, including alloys, semimanufactures.		10	48	United Kingdom 22; United States 9; Canada 8.
Manganese, oxides		80	190	Netherlands 129; Japan 60.
Mercury	76-pound flasks	348	203	Italy 87; Netherlands 58; United States 58.
Nickel, metal, including alloys, all forms		r 100	122	Italy 41; United Kingdom 36; West Germany 22.
Platinum group metals:				
Metals, including alloys, all forms.	troy ounces	4,855	30,768	NA.
Silver, metal, including alloys	do	473,549	442,910	United Kingdom 204,511; West Germany 185,735.
Tantalum, metal, including alloys, all forms.	kilograms	71	498	NA.
Tin, metal, including alloys, all forms.	long tons	145	182	United Kingdom 102.
Titanium, oxides		1,606	1,314	Finland 361; United Kingdom 335; Italy 225.
Tungsten, metal, including alloys, all forms.	kilograms	85	325	NA.
Zinc:				
Oxide		374	431	France 285; Netherlands 68.
Metal, including alloys, all forms		r 2,974	4,170	Belgium 1,428; Australia 691; United Kingdom 615.
Other:				
Ores and slag		667	744	Switzerland 514.
Oxides and hydroxides of metals, n.e.s.		19	28	NA.
Rare-earth metals		2	4	NA.
Base metals, including alloys, all forms, n.e.s.		37	63	Netherlands 24; United Kingdom 19; West Germany 14.
NONMETALS				
Abrasives, n.e.s.:				
Natural		109	112	NA.
Corundum, artificial		270	183	West Germany 113; France 34.
Grinding wheels, stones, powders.	value, thousands	$360	$321	NA.
Asbestos		5,851	4,269	Canada 2,472; Republic of South Africa 1,061.
Barite		526	1,007	Italy 861.
Bromine and iodine		12	12	NA.
Cement		r 13,010	8,343	Denmark 7,053.
Clays and clay products (including refractory brick):				
Crude clays, kyanite, andalusite, etc.		15,867	21,522	United Kingdom 9,401; Cyprus 4,400; Italy 4,133.
Products:				
Refractory		782	1,558	Austria 559; West Germany 378; United States 327.
Nonrefractory:				
Brick, pipe, etc.		48	7	NA.
Flags, setts, etc.	square meters	40,849	46,939	Italy 21,338; Japan 14,172.
Cryolite and chiolite		111	106	NA.
Diamond:				
Gem, not set or strung.	thousand carats	3,125	3,090	United Kingdom 1,684; United States 498; Netherlands 391.

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Table 4.—Israel: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Diamond—Continued			
Industrial, including bort. thousand carats	1,824	1,353	African countries 411; Belgium 401; Netherlands 145.
Diatomite	349	355	United States 226.
Feldspar	1,977	1,650	Italy 540; Norway 385; France 356.
Fertilizer materials: Manufactured:			
Nitrogenous, including urea	4,184	9,138	Italy 3,251; Rumania 3,249; Austria 805.
Other	15	226	NA.
Fluorspar	323	524	NA.
Graphite, natural	46	44	NA.
Gypsum and plasters	175	173	NA.
Magnesite	r 1,174	1,186	Austria 1,115.
Meerschaum and amber	137	-------	
Mica, crude, including splittings and waste	124	68	NA.
Pigments, mineral, processed iron oxides	241	236	NA.
Salt (excluding brines)	236	1,156	NA.
Sodium and potassium compounds, n.e.s	925	645	France 136; Belgium 122; Netherlands 100.
Stone, sand, and gravel:			
Dimension stone, crude and partly worked:			
Calcareous	6	136	NA.
Other	211	72	NA.
Crushed rock	647	985	NA.
Quartz and quartzite	500	772	Belgium 545.
Sulfur:			
Elemental, all forms	59,477	73,428	United States 36,400; West Germany 9,800; France 9,782.
Sulfuric acid	9,895	42,307	Sweden 18,501; Italy 9,527; Switzerland 6,212.
Talc and steatite	1,430	1,452	France 596; Austria 310.
Other nonmetals, n.e.s	73	23	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	28	66	NA.
Bituminous mixtures	337	197	United Kingdom 109; United States 61.
Carbon black	502	714	United States 418; France 109.
Coal, all grades, including briquets	1,378	266	NA.
Coke and semicoke	6,479	6,305	Italy 4,925; West Germany 1,380.
Peat	743	303	Finland 118; United Kingdom 115.
Coal products	832	441	Netherlands 187; United Kingdom 188.
Petroleum:			
Crude and partly refined, thousand 42-gallon barrels •	r 29,000	r 36,350	NA.
Refinery products: • r			
Aviation gasoline do	76	151	NA.
Residual fuel oil do	1,703	725	NA.
Lubricants do	73	132	NA.
Other do	26	6	NA.
Total do	1,878	1,014	NA.

• Estimate. r Revised. NA Not available.
[1] Includes estimated receipts from Israeli-occupied Sinai Peninsula oilfields.

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Table 5.—Israel: Value of principal mineral commodity foreign trade

(Thousand dollars)

Commodity	1966	1967
EXPORTS [1]		
METALS		
Aluminum	$1,488	$1,319
Copper:		
Cement copper	12,160	10,438
Other metallic	5,222	2,965
Iron and steel	3,064	2,687
NONMETALS		
Bromine and products	2,295	2,318
Diamond, gem, worked (gross)	189,536	193,040
Phosphate, beneficiated	4,424	4,614
Potash	12,704	13,559
IMPORTS		
METALS		
Aluminum	6,296	6,099
Copper	11,223	8,081
Iron and steel	41,083	36,572
NONMETALS		
Diamond:		
Gem, crude (gross)	138,856	137,913
Industrial	7,211	6,449
Sulfur	3,156	4,654
MINERAL FUELS		
Petroleum, crude	52,879	[2] 52,946

[1] Does not include petroleum refinery products, complete data for which are not available.
[2] Does not include crude petroleum from Israeli-occupied Sinai Peninsula oilfields.

COMMODITY REVIEW

METALS

Copper.—Timna Copper Co. produced 1,053,000 tons of ore containing 1.1 percent copper during 1968. This project, which showed a profit of $1.1 million, was the only profitable mining operation during the year. The main reasons for the improvement were increased productivity and high world copper prices.

Work started on a $9 million development project for exploitation of a new higher grade ore body near the existing mine. A 350-meter shaft was planned. Partial production was expected in 1972, and full-scale operations in 1974. This new ore body contains an average of 1.4 percent copper and reserves for an estimated 20 years.

At the copper processing plant, plans have been made to substitute hydrochloric acid for sulfuric acid, which requires 30,000 tons of imported sulfur annually. A proposed pipeline from the Dead Sea Works at Sedom to Timna would carry salt brine for use in making hydrochloric acid, but the economic and technical feasibility of such a project has not been established.

NONMETALS

Fertilizer Materials.—*Nitrogenous.*—A potassium nitrate plant was under construction at Haifa for Haifa Chemicals Ltd. Ultimate capacity will be 100,000 tons of fertilizer annually, using 75,000 tons of potash, 60,000 tons of phosphate, and 12,000 to 20,000 tons of ammonia.[6]

Phosphate.—About 1.9 million tons of crude phosphate rock was mined in 1968, essentially all from the Oron deposit of Chemicals and Phosphates Ltd. (C & P). This mine output was beneficiated to 777,000 tons of marketable phosphate containing 29 to 35.5 percent P_2O_5. Expansion underway calls for a beneficiated phosphate rock output rate of 1.2 million tons per year by 1970. C & P showed a deficit of $3.4 million in fiscal 1967 (ending March 31, 1967) and $1.7 million in fiscal 1968. During fiscal 1969, foreign shipments were expanded and a more favorable balance sheet appeared probable.[7]

The C & P expansion program included a new terminal at Rotterdam, Netherlands,

[6] Phosphorus and Potassium. No. 39, January–February 1969, p. 39.
[7] U.S. Embassy, Tel Aviv. State Department Airgram A-1387, Dec. 27, 1968, 2 pp.

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construction of which started in October 1968. Phosphate will be transported in 30,000-deadweight-ton bulk carriers from Ashdod.[8]

Arad Chemical Industries Ltd. awarded a construction contract to A. P. V. Kestner Ltd., a British firm, for a $1.8 million, 500-ton-per-day phosphoric acid evaporator at Arad. The plant was expected to be on stream in 1970.[9]

Potash.—Dead Sea Works (DSW) operated at a loss of $4 million in fiscal 1968, compared with a loss of $1.4 million in 1967. The increased deficit was attributed to disrupted world markets for potash resulting from the June 1967 war and a decline in world prices from $30 per ton to $22 per ton. As a result, DSW has a 300,000-ton stockpile of potash not marketable during 1967–68.

A $10 million expansion program underway to an annual rate of 1.2 million tons may raise the operation to the profit level by 1971.

MINERAL FUELS

Petroleum.—Israel commenced production of crude oil from occupied Sinai Peninsula fields shortly after the Arab-Israeli conflict of June 1967. During 1968 this operation was expanded. Output from Sinai was not disclosed, but unofficial estimates vary from 50,000 to 100,000 barrels per day. The oil was shipped to Eilat, where it entered the 16-inch pipeline to the Haifa refinery.

The 36-well output from the small Heletz, Brur, and Kokhav fields in Israel, southeast of Ashkelon, was 831,000 barrels, only about 3 percent of estimated demand during the year. Crude oil reserves were estimated at 15 million barrels.[10]

Exploration activity declined compared with previous years. Exploratory and developmental drilling continued, but no significant discoveries were made. Eleven holes were drilled during the year, mainly in the coastal area. In November 13,484 square kilometers were covered by petroleum rights. Operating companies plan deeper drilling, offshore operations, and intensified geophysical studies.

Belpetco Israel Ltd. drilled two dry holes, one to 9,117 feet at Bat-Yam, and the other to 7,943 feet at Gedera. The company planned offshore drilling in the Mediterranean Sea during 1969, after completion of a geophysical survey showing favorable structures. Early in the year, Mayflower Oil Exploration Co. Ltd. was drilling in the Natanya area in participation with Paz Oil Corp. Ltd. and Israel National Petroleum Co. Ltd. Paz, which controls nearly half of the petroleum products market in Israel, also holds a 25-percent interest in Arava Exploration Co. Ltd. Arava, controlled 50 percent by United States Smelting, Refining, and Mining Co., abandoned a well at 11,417 feet at Melekh Sedom, southern end of the Dead Sea. Lapidot Israel Oil Prospecting Co. Ltd., a government-owned company operating the producing oilfields, planned drilling in the Nitzana-Halutza area.

Ditching for a new 42-inch, 260-kilometer, Eilat-to-Ashkelon pipeline started in January. Initial planned capacity is 400,000 barrels per day, expandable to 1 million barrels per day with additional pumping stations. Steel for the pipeline was ordered from West Germany (70 percent) and Italy (30 percent). The Israeli Government purchased the existing 16-inch, Eilat-to-Haifa line from Tricontinental Pipeline Co. Ltd. for $23 million. This line will be operated in coordination with the new line. After completion of the project, the Government plans to transfer shares to Ashkelon Pipeline Co. Holdings Ltd., a Canadian firm, which will be owner and operator of the line. Trans-Asiatic Oil Co. Ltd. was formed to manage the sea transfer of crude oil. The initial stage of the new pipeline, which was estimated to cost $60 to $70 million, will be financed by foreign private interests (50 percent), the Israeli Government (25 percent), and local private interests (25 percent). The entire project will cost an estimated $100 to $120 million. The port at Eilat was under expansion to accommodate large tankers. At Ashkelon, moorings were under construction 3 kilometers offshore. Nine 57,000-ton tanks were being installed at Eilat and 13 at Ashkelon. A French firm won a $5 to $6 million contract for the tank installation. Zim Israel Navigation Co. Ltd., Haifa, ordered three tankers (86,500 deadweight tons, 121,000 d.w.t., and 232,000 d.w.t.) at a

[8] Page 50 of work cited in footnote 6.
[9] Page 7 of work cited in footnote 6.
[10] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 102.

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total cost of $40 million.[11] Plans also included orders for three supertankers in the 250,000-d.w.t. category.

A modest expansion of the Haifa refinery from 110,000 to 120,000 barrels per day, costing $4.8 million, was planned.[12] A new $60 million, 100,000-barrel-per-day refinery remained under consideration for location at Ashdod, 19 kilometers north of the new Ashkelon terminal.

Estimated consumption of refinery products during 1968 was as follows (in thousand barrels): Aviation gasoline 112, other gasoline 3,342, kerosine 2,900, distillate fuel oil 5,768, residual fuel oil 13,290, lubricants 145, liquefied petroleum gas 842, asphalt and bitumen 695, and other 1,193, for a total of 28,287 barrels.

Natural Gas.—Consumption increased about 10 percent as new industry was served with natural gas from the Kidod, Zohar, and Hakniam fields in the northern Negev. Naphtha Israel Oil Corp., the government-owned operator of the gasfields, completed an unproductive well at 10,285 feet in the Hakniam area. The company planned drilling in the Eshel area.

Reserves late in the year were an estimated 75 billion cubic feet.[13]

[11] Petroleum Press Service. V. 36, No. 3, March 1969 pp. 85–87.
[12] World Petroleum. V. 39, No. 8, Aug. 1, 1968, p. 6.
[13] Work cited in footnote 10.

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The Mineral Industry of Italy

By F. L. Klinger [1]

Italian production, consumption, and trade of mineral commodities in 1968 were substantially increased compared with the levels of recent years. The main stimulants were a relative boom in the domestic construction industry, and maintenance of strong foreign demand for Italian export products.

Except in the extraction of zinc, construction materials, and natural gas, the largest gains were realized in the manufacturing sectors of the mineral industry. The large iron, steel, and petroleum-refining industries continued to expand. Important improvements to production facilities in the lead and zinc industry were completed, and reorganization of the ailing sulfur industry continued. Tariff protection for lead, zinc, and sulfur, accorded by the European Economic Community (EEC) since 1960, ended or was at sharply reduced levels in 1968.

Significant discoveries of natural gas, made in 1968 in Italian offshore areas of the Adriatic Sea, increased Italy's energy resources and reduced the urgency of Italian negotiations with the U.S.S.R. and the Netherlands for additional gas supplies.

Italian Government companies acquired operating control of the giant Montecatini-Edison industrial firm in late 1968. The move increased potential state influence in the sectors of mining, nonferrous metals, and chemicals. Previously, these areas had been largely in the hands of private companies.

PRODUCTION

The overall index of production for the mining industry in 1968 showed an increase of 10.9 percent as compared with 1967 figures, the largest increase in several years. However, this relatively high figure resulted mainly from increased output of the large marble and construction materials industries. Although output of many commodities increased, the gains in the mining sector usually were less than the general index would indicate, as shown by the following indices:

Mining sector	Index of production (1966 = 100)	
	1967	1968
Metallic minerals	98.8	101.9
Nonmetallic minerals	104.8	108.4
Marble and other construction materials	111.0	133.9
Solid fuels	152.6	124.9
Oil and gas	103.5	111.0

Output of the mineral processing industries showed substantial gains, as shown in the accompanying tabulation:

Processing sector	Index of production (1966 = 100)	
	1967	1968
Ferrous metals	r 116.8	126.7
Nonferrous metals	r 103.4	116.9
Nonmetallic mineral manufacturing	r 115.1	130.8
Inorganic chemicals	107.9	110.1
Chemical fertilizers	105.3	114.2
Petroleum refineries	107.0	117.5
Coke plants	99.4	102.7

r Revised.

[1] Physical scientist, Division of International Activities.

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Table 1.—Italy: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite	r 247,800	r 244,393	r 255,486	r 242,027	216,197
Alumina, anhydrous	262,687	278,139	270,745	285,506	298,825
Metal:					
Primary	115,595	123,976	r 127,790	127,778	142,848
Secondary	58,000	61,000	85,000	102,000	102,000
Antimony, mine output, metal content	276	266	265	367	785
Bismuth, metal [1]	1	4	12	NA	NA
Cadmium, metal	r 264	r 281	245	218	250
Copper:					
Mine output, metal content	766	710	1,150	1,680	2,304
Cement	r 3,391	2,800	r 2,667	r 2,873	NA
Metal refined, secondary	11,700	12,700	16,900	17,500	NA
Iron and steel:					
Iron ore and concentrate • [2] thousand tons	976	1,085	1,078	1,087	1,058
Roasted pyrite [3] do	823	839	925	r 738	862
Pig iron do	3,498	5,490	6,259	7,294	7,826
Ferroalloys do	127	139	158	170	168
Steel, ingots and castings do	9,793	12,681	13,689	15,890	16,964
Steel semimanufactures:					
Wire rod do	553	674	646	771	805
Other bars and rods do	2,660	2,919	3,343	4,018	4,402
Sections do	644	725	316	452	477
Plates and sheets do	829	952	1,032	1,349	1,480
Coils do	1,650	3,041	3,517	4,033	4,527
Strip do	468	550	551	611	627
Seamless tube do	724	784	798	852	868
Other do	214	224	200	148	192
Total hot rolled do	7,742	9,869	10,403	12,234	13,328
Castings and forgings do	200	208	229	298	319
Cold rolled sheet do	1,858	2,216	2,467	2,685	2,781
Lead:					
Mine output, metal content	32,325	35,469	36,700	38,670	36,475
Metal:					
Primary	r 42,691	45,420	r 53,768	60,498	57,554
Secondary	6,500	7,900	10,800	11,800	NA
Magnesium, metal	r 6,011	r 6,279	6,515	r 6,817	6,593
Manganese ore	47,803	47,810	r 44,099	47,098	50,821
Mercury, metal 76-pound flasks	57,001	57,320	53,549	48,066	53,317
Silicon, elemental	17,750	19,750	18,728	r 19,821	NA
Silver, metal thousand troy ounces	1,074	1,103	1,182	1,382	1,156
Zinc:					
Mine output, metal content	118,311	115,500	116,400	124,700	139,800
Metal, primary	73,013	80,898	77,229	89,026	112,274
NONMETALS					
Asbestos	r 68,556	r 71,928	r 82,325	r 101,062	• 104,000
Barite	102,895	143,017	158,852	154,066	203,980
Boron materials (from natural steam)	319	86	------	------	------
Bromine, elemental	1,605	2,059	1,977	NA	NA
Cement:					
Hydraulic thousand tons	22,840	20,695	22,430	26,272	29,536
Natural do	4,814	3,800	3,971	3,981	5,281
Other (pozzolan) do	4,067	3,869	3,808	4,278	NA
Clays:					
Bentonite do	131	152	202	245	261
Fire clay do	250	220	r 275	266	265
Fuller's earth do	205	170	r 140	93	66
Kaolin do	97	108	r 85	88	82
Kaolinitic earth do	94	49	r 36	16	• 15
Other (for terracotta, bricks, etc.) do	27,255	21,767	24,215	• 26,000	• 30,000
Diatomite	69,350	63,266	62,715	59,954	• 60,000
Earths, for foundry use thousand tons	216	418	416	NA	NA
Feldspar	111,614	96,999	r 147,217	147,462	168,382
Fertilizer materials:					
Crude potassium salts, natural do	1,470	1,723	1,859	1,813	1,929
Manufactured:					
Nitrogenous, gross weight do	2,687	3,087	3,183	3,435	3,554
Phosphatic:					
Thomas slag, gross weight do	88	18	------	------	------
Other do	1,279	1,390	1,671	1,575	1,625
Potassic do	318	352	376	324	335
Mixed and unspecified do	1,778	1,688	1,800	1,942	2,101
Fluorspar, all grades	124,694	153,333	r 176,012	205,196	224,981

See footnotes at end of table.

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Table 1.—Italy: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Graphite, all grades	r 1,631	r 1,170	1,070	1,877	1,412
Gypsum and anhydrite, crude thousand tons	2,441	3,080	r 3,270	2,734	• 3,300
Lime (quicklime and hydrated lime) e do	5,100	r 5,100	5,100	4,900	5,000
Magnesite, crude	6,309	3,536	2,601	4,492	NA
Pigments, natural mineral	4,990	680	540	NA	NA
Pumice and pumiceous lapilli thousand tons	963	817	773	NA	NA
Pyrite (including cupreous):					
Gross weight thousand tons	1,395	1,402	1,304	1,411	1,406
Sulfur content do	528	630	587	635	633
Quartz:					
Common quartz, ground do	34	34	41	NA	NA
Glass sand do	3,105	3,267	3,277	3,225	NA
Salt:					
Marine, crude do	818	1,058	1,141	1,274	• 1,300
Other, including brine do	r 2,037	r 2,131	r 2,120	2,577	2,626
Stone, sand and gravel, n.e.s.:					
Dimension stone:					
Limestone and other calcareous:					
Alabaster, including onyx	22,843	6,522	7,334	NA	NA
Gypsum, other than alabaster	85,615	88,050	91,060	NA	NA
Limestone	483,903	437,324	r 444,006	365,090	NA
Marble, in blocks:					
White	646,441	634,885	697,877	750,902	NA
Colored	764,753	831,991	886,967	501,303	
Schist	30,672	25,469	33,047	NA	NA
Travertine and tufa thousand tons	1,633	1,303	r 1,243	1,487	NA
Other:					
Granite and gneiss do	160	138	144	NA	NA
Lava and porphyry do	779	488	444	NA	NA
Sandstone and quartzite do	120	118	136	NA	NA
Serpentine do	102	139	79	NA	NA
Slate do	57	59	61	NA	NA
Volcanic tuff and other do	752	693	655	NA	NA
Crushed and broken:					
Dolomite:					
For magnesium manufacture	81,509	69,573	65,604	59,710	NA
Other thousand tons	834	913	966	NA	NA
Limestone do	57,548	53,805	55,955	NA	NA
Other do	22,469	24,100	22,596	NA	NA
Gravel and sand do	37,640	33,505	38,747	NA	NA
Sand (volcanic) do	237	180	180	NA	NA
Strontium minerals	750	640	598	660	778
Sulfur, native:					
Ore, ground for agricultural use	NA	17,897	18,451	23,297	22,538
Concentrates (90 percent sulfur)	67,041	r 59,262	79,538	73,492	90,506
Fused, in briquets	r 28,796	r 16,078	r 13,874	9,836	7,027
Talc and related materials	133,830	121,455	r 113,129	118,467	115,859
MINERAL FUELS AND RELATED MATERIALS					
Asphaltic and bituminous rock:					
For distillation	238,239	208,509	238,284	236,162	201,604
For paving	108,046	59,859	54,024	70,774	76,760
Carbon black	64,300	73,900	83,665	90,605	93,310
Coal:					
Anthracite	9,486	5,592	85	-------	-------
Subbituminous (Sulcis coal)	461,985	383,444	417,802	410,408	365,131
Lignite thousand tons	1,203	1,011	1,066	2,201	1,728
Coke:					
Metallurgical do	4,683	5,737	6,267	6,246	6,476
Gas do	542	386	340	317	269
Gas, natural:					
Gross production million cubic meters	7,684	7,802	8,825	9,367	10,418
Marketed do	7,604	7,728	8,399	9,165	• 10,200
Natural gas liquids	63,123	68,024	92,201	106,819	121,189
Petroleum:					
Crude oil thousand tons	2,669	2,210	1,757	1,616	1,506
Refinery products:					
Gasoline do	7,407	8,543	10,185	11,693	12,795
Kerosine and jet fuel do	1,622	2,340	2,925	3,475	4,326
Distillate fuel oils do	4 15,536	4 18,910	56,547	59,105	62,607
Residual fuel oils do	5 25,384	5 30,078			
Liquefied petroleum gas do	1,087	1,272	1,474	1,605	1,705
Lubricants do	259	347	443	446	492
Petrochemical feedstocks do	1,106	1,702	1,690	2,257	• 4,787
Asphalt and bitumen do	1,226	1,228	1,299	1,483	1,704
Other do	505	800	1,292	1,109	237

See footnotes at end of table.

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Table 1.—Italy: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
Petroleum—Continued					
Total refinery products.....thousand tons..	54,132	65,220	75,855	81,173	88,653
Refinery fuel and loss.....do....	3,714	4,152	4,760	5,173	5,564
Total refinery throughput.....do....	57,846	69,372	80,615	86,346	94,217

• Estimate. r Revised. NA Not available.
[1] Production reported by Monteponi-Montevecchio S.p.A.
[2] Including pelletized iron oxide derived from pyrite.
[3] Net exports plus consumption in iron and steel works.
[4] Includes gas oil, and fuel oils below 5 degrees Engler ("fluidissimo" and "fluido").
[5] Includes fuel oils above 5 degrees Engler ("semifluido" and "denso").

TRADE

Preliminary data indicated that Italy achieved a near-balance in total commodity trade in 1968, compared with a deficit of nearly $1 billion in 1967. About one-fourth of the net gain was attributable to trade in mineral commodities, principally ferrous metals and petroleum products, although exports of many commodities increased. In total trade, the United States remained Italy's principal trading partner, accounting for 11.6 percent of the value of goods imported by Italy, and 10.7 percent of the value of Italy's exports. In the value of mineral commodities, West Germany was the main destination of exports, and Libya replaced Kuwait as the principal source of imports.

General trade relationships and the value of trade in the principal mineral commodities are shown in the following tabulations:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1966	1,192	8,032
1967	1,277	8,702
1968	1,573	10,183
Imports:		
1966	2,682	8,571
1967	3,171	9,697
1968	3,241	10,253

[1] Excluding gold.

Sources: 1966 and 1967, United Nations Statistical Office (New York). 1968: Central Institute of Statistics (*Istituto Centrale di Statistica—ISTAT*) (Rome). Monthly Statistics of Foreign Trade (Statistica Mensile del Commercio con l'Estero). v. 84, no. 12, (December 1968). Values converted from Italian lire at Lit. 625 = U.S.$1.

Commodity	Value (million dollars) [1]	
	1967	1968
Exports:		
Iron and steel [2]	355.6	392.0
Copper [2]	38.6	54.7
Aluminum [2]	30.0	50.2
Mercury	16.9	18.3
Fertilizer materials [3]	67.9	74.7
Dimension stone	77.4	88.5
Petroleum products	526.8	600.0
Imports:		
Iron ore	99.7	99.1
Iron and steel [2]	669.8	617.1
Copper [2]	288.4	297.3
Aluminum [2 4]	103.5	94.8
Fertilizer materials [3]	43.8	42.8
Coal and coke	171.9	154.3
Petroleum, crude	1,328.1	1,423.3
Petroleum products	89.5	95.0

[1] Converted from lire, at the rate of Lit. 625 = $1.00.
[2] Including scrap.
[3] Including manufactured fertilizer.
[4] Including bauxite and aluminum oxide and hydroxide but excluding artificial corundum.

Source: Central Institute of Statistics (*Istituto Centrale di Statistica—ISTAT*). (Rome). Monthly Statistics of Foreign Trade (Statistica Mensile del Commercio con l'Estero). v. 84, nos. 6 and 12 (June and December, 1968).

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Table 2.—Italy: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite and concentrate	1,615	320	Switzerland 317.
Oxide and hydroxide	9,663	10,672	Austria 7,570; Switzerland 1,742.
Metal, including alloys:			
Scrap	231	98	West Germany 27; Belgium-Luxembourg 26.
Unwrought	20,643	4,947	Argentina 3,218; Yugoslavia 831.
Semimanufactures	27,068	29,946	United States 9,305; West Germany 2,966.
Cadmium metal, including alloys, all forms	135	75	Netherlands 50; West Germany 25.
Copper:			
Ore and concentrate	2,404	6,101	Czechoslovakia 2,439; Spain 1,460; Poland 1,155.
Matte	188	45	All to West Germany.
Metal, including alloys:			
Scrap	330	277	Austria 152.
Unwrought:			
Unalloyed	3,478	4,947	Argentina 3,218.
Blister and other unrefined, unalloyed.	591	844	Switzerland 171.
Refined	5,089	5,812	United States 1,949; Belgium-Luxembourg 1,238; Netherlands 1,016.
Master alloys	170	37	Belgium-Luxembourg 33.
Semimanufactures	23,944	19,064	Switzerland 2,213; Rumania 2,009; France 1,847.
Germanium metal, including alloys all forms. value, thousands	$113	$102	NA.
Gold metal, unworked or partly worked. troy ounces	6,430	NA	
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	19	19	NA.
Roasted pyrite do	752	718	Austria 300; West Germany 190; United States 188.
Metal:			
Scrap do	2	3	West Germany 2.
Pig iron, including cast iron, powder and shot. do	4	3	France 2.
Ferroalloys do	20	19	West Germany 6; United States 4; Australia 2.
Steel, primary forms do	158	161	United States 43; France 38; Spain 26; Israel 24.
Semimanufactures:			
Bars, rods, angles, shapes, sections. do	661	554	West Germany 168; France 116.
Universals, plates, and sheets do	717	699	Mainland China 104; West Germany 100; France 99; Yugoslavia 89.
Hoop and strip do	70	58	Greece 18; Switzerland 8; Yugoslavia 7.
Rails and accessories do	18	10	Switzerland 4; United Arab Republic 2.
Wire do	15	16	Rumania 3; Poland 2; Libya 2.
Tubes, pipes and fittings do	456	563	Libya 95; United Kingdom 80.
Castings and forgings, rough do	8	8	France 2; Switzerland 1.
Total semimanufactures	1,945	1,908	
Lead:			
Ore and concentrate	2,906	3,458	Austria 2,700.
Oxides	1,703	263	Hungary 170.
Metal, including alloys:			
Unwrought	103	292	NA.
Semimanufactures	155		
Magnesium metal, including alloys:			
Scrap	70	297	NA.
Unwrought	4,645	3,184	France 152; West Germany 78.
Manganese:			
Ore and concentrate	557	300	All to West Germany.
Metal, all forms	1	10	Mainly to Yugoslavia.
Mercury 76-pound flasks	45,427	36,931	United Kingdom 8,792; United States 8,791; Japan 5,835; West Germany 3,706.
Nickel:			
Matte	10	---	
Metal, including alloys:			
Unwrought, including scrap	94	157	France.
Semimanufactures	1,037	842	Iran 169; Morocco 124.

See footnotes at end of table.

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Table 2.—Italy: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Platinum-group metals and silver:			
Ore and concentrate ---------- kilograms	11,300	3	France 1; West Germany 1; Japan 1.
Metals, including alloys:			
Platinum group. thousand troy ounces	38	37	West Germany 29; France 3.
Silver ---------- do	363	48	Belgium-Luxembourg 15; France 8.
Selenium, elemental ---------- kilograms	4,821	1,082	West Germany 942.
Silicon, elemental ----------	10,505	9,116	West Germany 3,174; United Kingdom 2,783.
Tin metal, including alloys, all forms. long tons	264	127	Austria 55.
Titanium oxides ----------	19,222	17,685	United Kingdom 2,010; Poland 1,508.
Tungsten:			
Ore and concentrate ----------	9	30	France 17; United Kingdom 10.
Metal, including alloys, all forms ----------	13	31	France 9; West Germany 7; Netherlands 6.
Zinc:			
Ore and concentrate ----------	41,153	22,258	Austria 12,098; Yugoslavia 6,930.
Oxides ----------	1,100	332	France 371; Yugoslavia 121; West Germany 120.
Metal, including alloys:			
Blue powder ----------	NA	435	Rumania 228; Netherlands 101; Hungary 80.
Unwrought ----------	61	634	Switzerland 333.
Semimanufactures ----------	328		
Other:			
Ore and concentrate ----------	16,524	1,661	NA.
Ash and residues containing nonferrous metals.		18,401	West Germany 11,086; Belgium-Luxembourg 2,556.
Oxides, hydroxides and peroxides of metals n.e.s.	434	184	West Germany 70; Switzerland 40; Belgium-Luxembourg 26.
Metals, including alloys, all forms:			
Metalloids n.e.s ----------	330	1,280	United Kingdom 303; United States 303; Japan 201; West Germany 128.
Base metals, including alloys, all forms.	26	98	Netherlands 51; West Germany 25.
NONMETALS			
Abrasives:			
Natural:			
Pumice ----------	319,445	274,403	United States 80,027; United Kingdom 42,378; Netherlands 39,497; Libya 28,585.
Corundum, emery, garnet, tripoli and other.	1,062	2,347	United States 1,545; West Germany 137.
Dust and powder of precious and semiprecious stones.[1] kilograms	1	475	Mainly to United States.
Grinding and polishing wheels and stones	2,820	3,281	France 887; West Germany 284.
Asbestos ----------	35,937	34,026	West Germany 12,270; France 7,048.
Barite and witherite ----------	17,905	40,950	Netherlands 19,858; United States 15,317.
Cement ----------	465,484	413,545	Libya 183,683; Nigeria 52,445; Spain 44,027.
Chalk ----------	545	587	Switzerland 510.
Clay and clay products:			
Crude clays:			
Bentonite ----------	29,332	27,020	France 5,648; Iran 4,500.
Kaolin ----------	396	336	Greece 174; Belgium-Luxembourg 42; Switzerland 34.
Other ----------	14,085	21,400	France 18,852.
Products:			
Refractory (including nonclay bricks)	26,647	32,584	Switzerland 4,024; Turkey 3,727.
Nonrefractory ----------	414,383	409,775	France 81,371; Switzerland 77,831; Libya 67,904; West Germany 58,532.
Diamond:			
Gem, not set or strung, value, thousands	$70	$105	United Kingdom $65.
Industrial ---------- carats	20,000	15,000	Mostly to United Kingdom and Belgium-Luxembourg.
Diatomite and other infusorial earths ----------	1,527	1,647	France 469; Switzerland 457; Iran 313.
Feldspar ----------	23,586	24,812	West Germany 13,098; Netherlands 2,728.

See footnotes at end of table.

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Table 2.—Italy: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Fertilizer materials:			
Crude, potassic	-------	---------	
Manufactured:			
Nitrogenous---thousand tons	1,013	1,174	Mainland China 498; Turkey 179.
Potassic---do	152	127	Japan 16; Netherlands 15; United States 13.
Other, including mixed---do	367	406	Yugoslavia 72; Cuba 65.
Ammonia	6,311	8,100	Greece 5,000; United Arab Republic 1,323.
Fluorspar	55,276	85,277	United States 76,420; West Germany 5,484.
Graphite, natural	1,421	1,516	France 998; West Germany 135.
Gypsum and plasters	17,389	16,411	Switzerland 7,568; Nigeria 2,250; France 2,236.
Lime	55,290	62,045	Libya 46,819; Switzerland 12,896.
Magnesite	265	87	Portugal 30; West Germany 22; Switzerland 20.
Mica:			
Crude, including splittings and waste	582	328	Iran 152; Kuwait 63; United Arab Republic 30.
Worked, including agglomerated splittings	35	27	NA.
Pigments, mineral, including processed iron oxides.	1,530	1,462	United States 594; West Germany 141.
Precious and semiprecious stone, except diamond:			
Natural---kilograms	3,158	2,551	Mostly to Switzerland.
Manufactured---do	541	991	Switzerland 517.
Pyrite (gross weight)	52,301	52,085	Switzerland 46,188; Austria 5,188.
Salt	18,699	45,643	Greece 34,220.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	182,767	197,523	U.S.S.R. 88,272; Greece 22,376.
Caustic potash	2,451	42	All to Austria.
Stone, sand and gravel:			
Dimension stone: Crude and partly worked:			
Calcareous	266,630	274,924	West Germany 63,775; France 45,002.
Slate	7,339	6,391	West Germany 1,755; Switzerland 1,568.
Other	276,640	316,101	West Germany 145,781; France 88,683; United States 34,327.
Dolomite, chiefly refractory grade	15,310	15,156	Switzerland 7,020; Austria 1,937.
Gravel and crushed rock	392,818	398,525	West Germany 126,000; Switzerland 48,000.
Limestone (except dimension)	1,120	1,215	Switzerland 1,132.
Quartz and quartzite	26,780	21,172	France 8,457; Switzerland 8,304.
Sand, excluding metal bearing	182,415	180,662	Switzerland 177,283.
Strontium minerals	119	119	All to Norway.
Sulfur, elemental, all forms	1,780	2,486	Thailand 1,103.
Talc, steatite, soapstone, and pyrophyllite	39,450	32,532	United Kingdom 6,132; West Germany 6,078; France 4,317; United States 4,044.
Other nonmetals n.e.s.:			
Mineral substances	95,664	55,388	United Kingdom 40,706; Switzerland 12,594.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture	r 20,966	18,611	Switzerland 6,665; Austria 5,957; Yugoslavia 2,923; France 2,872.
Slag and ash n.e.s	2,532	1,572	West Germany 1,506.
Bromine, iodine, fluorine	94	128	West Germany 126.
Inorganic acids and oxygen compounds	195,753	151,996	Greece 60,649; Turkey 51,615.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,321	7,422	United Kingdom 6,223; France 600.
Carbon black	24,516	21,812	West Germany 6,404; Austria 4,169; Yugoslavia 2,684.
Coal, all grades, including briquets	3,616	3,045	Argentina 946; Switzerland 736; France 490.
Coke and semicoke	153,716	218,684	Portugal 54,879; Austria 50,914; France 30,912.
Hydrogen, helium and rare gases	258	105	Spain 27.
Petroleum refinery products:[2]			
Gasoline---thousand tons	3,316	4,075	Belgium-Luxembourg 758; United Kingdom 620; Sweden 536.

See footnotes at end of table.

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Table 2.—Italy: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
MINERAL FUELS AND RELATED MATERIALS—Continued			
Petroleum refinery products—Continued			
Kerosine and jet fuel ---do---	978	1,108	Belgium-Luxembourg 226; Netherlands 134.
Distillate fuel oil ---do---	7,645	8,205	Belgium-Luxembourg 1,682; West Germany 1,562; Netherlands 1,359; France 916.
Residual fuel oil ---do---	8,172	7,453	Belgium-Luxembourg 1,531; United States 1,329; United Kingdom 904.
Liquefied petroleum gases ---do---	177	217	Spain 60; France 42; Lebanon 25.
Lubricants ---do---	350	390	United States 115; Belgium-Luxembourg 86.
Bitumen and other ---do---	216	275	Austria 75; Libya 58; Switzerland 57.
Total ---do---	20,854	21,723	
Mineral tar and other coal, petroleum or gas derived chemicals.	3,377	1,419	NA.

NA Not available. r Revised.
[1] Includes synthetic.
[2] Excludes bunkers.

Table 3.—Italy: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	534,799	543,203	Yugoslavia 278,102; Sierra Leone 107,230.
Oxide and hydroxide	39,589	35,087	France 21,290; West Germany 4,849.
Metal, including alloys:			
Scrap	53,179	64,867	Canada 13,847; France 13,160; United States 12,383.
Unwrought	63,235	82,131	France 16,895; Norway 15,098.
Semimanufactures	20,617	26,350	West Germany 7,940; France 7,648; United States 3,182.
Antimony:			
Ore and concentrate	843	773	Morocco 351; mainland China 341.
Metal, including alloys, all forms	513	614	Belgium-Luxembourg 483; mainland China 53.
Arsenic trioxide, pentoxide and acids	1,612	1,487	France 1,211; mainland China 201.
Beryllium:			
Oxide ---kilograms---	2,350	3,080	United Kingdom 2,550; West Germany 520.
Metal, including alloys, all forms ---do---	r 2,000	6,425	France 6,072; Malagasy Republic 110.
Bismuth metal, including alloys, all forms	80	55	Netherlands 32; Japan 12.
Cadmium	63	99	Netherlands 25; Japan 20; United States 18.
Chromium:			
Chromite	112,259	94,823	U.S.S.R. 50,032; Turkey 16,167; Albania 12,482.
Oxide and hydroxide	882	887	West Germany 676; Poland 151.
Metals, including alloys, all forms	32	61	France 29; West Germany 17.
Cobalt:			
Oxide and hydroxide	258	236	Belgium-Luxembourg 222.
Metals, including alloys, all forms	389	332	Belgium-Luxembourg 258; United Kingdom 29.
Columbium and tantalum:			
Tantalum ore and concentrate	25	---	
Tantalum metal, including alloys, all forms	4	8	United States 4; West Germany 2.
Copper:			
Ores and concentrates	(1)	301	NA.
Matte	223	126	NA.
Metal, including alloys:			
Scrap	39,556	33,476	West Germany 13,067; France 10,127.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Copper—Continued			
Unwrought:			
Blister	2,563	4,296	West Germany 778; Chile 626; Congo (Kinshasa) 500; Republic of South Africa 431.
Refined	215,588	230,003	Chile 50,088; Zambia 45,414; Congo (Kinshasa) 36,602; United States 29,744.
Master alloys	282	682	United Kingdom 178; Belgium-Luxembourg 133; Bulgaria 100.
Semimanufactures	10,772	10,584	Yugoslavia 2,975; West Germany 2,452; Switzerland 1,220.
Gallium, indium, and thallium—kilograms	979	643	United States 410; Netherlands 97; West Germany 92.
Germanium—do	422	1,095	Belgium-Luxembourg 1,074.
Gold metal, unworked or partly worked—thousand troy ounces	1,193	NA	
Iron and steel:			
Ore and concentrate, except roasted pyrite—thousand tons	8,110	9,926	Liberia 2,554; Canada 1,394; Mauritania 1,197; Venezuela 1,022.
Roasted pyrite—do	51	119	Canada 78; Venezuela 41.
Metal:			
Scrap—do	4,100	4,969	West Germany 2,035; France 2,025.
Pig iron, including cast iron and spiegeleisen—do	826	1,072	West Germany 388; U.S.S.R. 200; Finland 174.
Sponge iron, powder and shot—do	8	11	France 5; Sweden 5.
Ferroalloys:			
Ferromanganese—do	78	87	France 39; Norway 15; Belgium-Luxembourg 15.
Other—do	53	65	France 16; Norway 14; Yugoslavia 9.
Steel, primary forms—do	989	1,288	West Germany 503; France 222; Belgium-Luxembourg 182.
Semimanufactures:			
Bars, rods, angles, shapes, sections—do	468	529	West Germany 178; France 107; Belgium-Luxembourg 86.
Universals, plates and sheets—do	941	1,005	West Germany 269; France 196; Belgium-Luxembourg 188.
Hoop and strip—do	121	106	France 37; Belgium-Luxembourg 29; West Germany 28.
Rails and accessories—do	26	48	France 31; West Germany 12.
Wire—do	20	23	Belgium-Luxembourg 6; Austria 5; Sweden 4; France 3.
Tubes, pipes, and fittings—do	76	93	West Germany 42; France 16; Yugoslavia 9; Sweden 9.
Castings and forgings, rough—do	1	2	Mainly from West Germany.
Total semimanufactures	1,653	1,806	
Lead:			
Ore and concentrate	19,993	20,850	Morocco 14,929; Algeria 2,806; France 2,174.
Oxides	2,776	4,783	Mexico 3,715; Yugoslavia 549.
Metal, including alloys:			
Scrap	24,993	30,229	West Germany 12,920; France 8,654; Switzerland 4,323.
Unwrought	45,827	60,397	Republic of South Africa 15,822; Mexico 7,525.
Semimanufactures	2,619	1,787	Yugoslavia 1,168; France 405.
Magnesium metal, including alloys:			
Scrap	314	47	Chile 30; Austria 11.
Unwrought	138	324	United States 289; West Germany 25.
Semimanufactures	30	66	Ireland 20; United States 19; West Germany 17.
Manganese:			
Ore and concentrate	91,778	152,965	Mainland China 46,634; Republic of South Africa 43,696; U.S.S.R. 19,980; United Arab Republic 15,000.
Oxides	806	1,341	Japan 1,197.
Metal	1,122	1,407	France 827; U.S.S.R. 176; Republic of South Africa 162; Japan 159.
Mercury—76-pound flasks	1,044	1,160	Yugoslavia 696; Mexico 319; West Germany 116.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Molybdenum:			
Ore and concentrate	2,005	2,519	United States 944; Netherlands 867; Canada 531.
Metal, including alloys, all forms	28	25	Austria 13; Netherlands 3; West Germany 3.
Nickel:			
Matte, speiss, and similar materials	1,745	1,805	Canada 1,442; United Kingdom 216.
Metal, including alloys:			
Scrap	973	1,555	United States 1,219.
Unwrought	11,160	12,061	United Kingdom 3,648; Canada 2,083; France 1,319; Norway 1,278.
Semimanufactures	1,598	2,127	West Germany 562; United Kingdom 449; United States 318.
Platinum-group metals and silver:			
Waste and sweepings, troy ounces	16,493	18,487	Yugoslavia 9,324; Netherlands 3,344; France 2,476; Rumania 2,315.
Metals, including alloys:			
Platinum group, thousand troy ounces	290	214	West Germany 114; United States 54; United Kingdom 80.
Silver, do	28,663	30,040	West Germany 10,895; United States 8,860; United Kingdom 6,867.
Selenium, elemental	17	21	Japan 8; Belgium-Luxembourg 6; Sweden 4.
Silicon, elemental	23	(1)	NA.
Tin:			
Oxides, long tons	38	64	West Germany 49; Japan 15.
Metal, including alloys:			
Scrap, do	5,909	19	West Germany 9; Panama 6.
Unwrought, do		6,107	Malaysia 3,841; Netherlands 1,988; Thailand 674.
Semimanufactures, do	83	82	West Germany 43.
Titanium:			
Ore and concentrate	114,900	106,398	Norway 60,641; Finland 24,013; Australia 15,716.
Oxides	18,126	21,147	West Germany 6,968; United Kingdom 5,814; Belgium-Luxembourg 2,858.
Metal, including alloys, all forms	63	378	United States 302; West Germany 42.
Tungsten:			
Ore and concentrate	46	46	NA.
Oxides	7	11	United Kingdom 9.
Metal, including alloys, all forms	74	81	West Germany 16; France 14; Malaysia 11; Thailand 10; United States 10.
Uranium and thorium:			
Ore and concentrate	10	102	United States 41; Australia 33; West Germany 17; Israel 11.
Metal, including alloys, all forms, kilograms	218	339	Belgium-Luxembourg 190; United Kingdom 99; West Germany 50.
Vanadium pentoxide	251	235	West Germany 140; Republic of South Africa 51; United States 23.
Zinc:			
Ore and concentrate	4,631	21,418	Greece 6,455; Morocco 5,009; Tunisia 4,500; Algeria 3,204.
Oxide	3,071	2,949	Netherlands 1,037; Poland 482; West Germany 435; East Germany 375.
Metal, including alloys:			
Scrap	7,114	8,040	West Germany 3,913; France 2,277; Switzerland 1,041.
Blue powder	2,816	2,887	Belgium-Luxembourg 2,481.
Unwrought	55,241	66,006	West Germany 9,527; Belgium-Luxembourg 8,456; Canada 7,739; Austria 6,659.
Semimanufactures	550	712	Yugoslavia 353.
Zirconium:			
Ore and concentrate	14,487	17,804	Australia 17,681.
Oxides	395	435	West Germany 287; United Kingdom 68; France 59.
Metal, including alloys, all forms, kilograms	2,604	4,589	United Kingdom 2,928; West Germany 628; France 486.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Other:			
Ore and concentrate	9,504	11,463	United Arab Republic 10,160; Australia 996; Austria 141; France 140.
Ash and residues containing nonferrous metals:			
Copper	659	300	Switzerland 280.
Lead	1,584	2,192	West Germany 1,414; Switzerland 249; France 242.
Zinc	11,836	9,396	Switzerland 3,574; West Germany 2,086; France 1,444.
Other	20,560	45,092	Canada 17,898; Austria 9,026; France 5,534; Yugoslavia 4,797.
Oxides, hydroxides and peroxides of metals n.e.s.	1,678	1,771	West Germany 1,060; Belgium-Luxembourg 166.
Metals, including alloys, all forms:			
Metalloids	29	62	Sweden 51.
Alkali, alkaline earth and rare-earth metals.	6,007	8,593	West Germany 4,316; France 2,373; U.S.S.R. 1,653.
Pyrophoric alloys	2	1	All from West Germany.
NONMETALS			
Abrasives:			
Pumice, natural corundum, including garnet.	143	231	West Germany 98; United States 76; United Kingdom 30.
Emery	1,349	942	Greece 789; Netherlands 87.
Tripoli	1,710	1,896	West Germany 1,718.
Dust and powder of value, thousands	$1,738	$1,929	Netherlands $661; Belgium-Luxembourg $454.
precious and semiprecious stones.			
Grinding and polishing wheels and stones	3,428	3,803	West Germany 981; France 694; United Kingdom 580; Austria 565.
Asbestos	43,620	45,430	Republic of South Africa 20,668; Canada 14,722; U.S.S.R. 7,859.
Barite and witherite	40,975	6,708	Mainland China 3,332; France 2,280; Morocco 810.
Borates, crude natural	73,554	70,753	Turkey 64,430; United States 6,079.
Cement	40,030	72,625	France 39,628; Israel 28,501.
Chalk	8,658	6,351	France 5,324; Austria 906.
Clays and clay products:			
Crude clays, n.e.s.:			
Bentonite	2,657	7,536	Greece 4,258; United States 2,561.
Kaolin	326,465	377,836	United Kingdom 264,493; United States 41,133.
Other	505,715	546,218	France 192,009; West Germany 145,818; United Kingdom 99,264.
Products:			
Refractory (including nonclay bricks)	65,153	63,669	West Germany 27,307; Austria 10,316; France 6,783.
Nonrefractory	11,167	12,216	West Germany 7,386; Czechoslovakia 1,293.
Cryolite and chiolite	568	633	Denmark 625.
Diamond:			
Gem, not set or strung—value, thousands	$3,339	$3,664	Belgium-Luxembourg $1,541; United Kingdom $382.
Industrial—carats	310,000	420,000	United Kingdom 220,000; France 125,000; United States 55,000.
Diatomite and other infusorial earths	9,620	6,222	Hungary 2,959; United States 1,523; France 651.
Feldspar (excluding nepheline)	10,375	17,188	Portugal 4,233; West Germany 4,093; Sweden 4,087; Republic of South Africa 1,869.
Fertilizer materials:			
Crude:			
Nitrogenous	1,350	21,154	Chile 20,593.
Phosphatic—thousand tons	1,877	1,900	United States 923; Morocco 394; Jordan 207; Tunisia 196.
Potassic	41,643	44,759	France 32,807; West Germany 10,741.
Manufactured:			
Nitrogenous	2,938	5,431	NA.
Phosphatic	155,455	143,075	Belgium-Luxembourg 77,757; France 47,058.
Potassic	223,483	206,016	Israel 61,327; Spain 39,880; France 38,049; U.S.S.R. 32,892.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Fertilizer materials—Continued			
Other, including mixed	10,184	33,079	United States 19,259; Austria 5,111; West Germany 4,758; France 3,583.
Ammonia	835	516	Hungary 500; West Germany 15.
Fluorspar	14,876	32,889	Mozambique 4,653; Republic of South Africa 4,163.
Graphite, natural	9,535	13,785	Austria 9,817; West Germany 2,250.
Gypsum and plasters	1,066	1,621	West Germany 1,090; United States 448.
Lime	1,354	1,805	Yugoslavia 1,698.
Magnesite	45,439	52,979	Greece 18,423; Austria 16,624; Yugoslavia 12,444.
Mica:			
Crude, including splittings and waste	1,898	2,777	Portugal 1,019; United Kingdom 494.
Worked, including agglomerated splittings	117	136	Belgium-Luxembourg 39; United States 11.
Pigments:			
Natural, crude	997	525	Spain 200; West Germany 137; Czechoslovakia 82; Cyprus 57.
Iron oxides, processed	7,298	9,089	West Germany 5,701; France 1,143; Spain 1,033.
Precious and semiprecious stone, except diamond:			
Natural—value, thousands	$763	$739	India $177; West Germany $143.
Manufactured—do	$884	$1,360	Switzerland $828; France $386; United States $125.
Pyrite, gross weight	958,484	1,205,000	U.S.S.R. 762,430; Cyprus 310,102.
Salt (including brines)	285	3,756	Rumania 3,320; West Germany 221.
Sodium and potassium compounds:			
Caustic soda	2,704	6,583	France 6,281.
Caustic potash	996	789	West Germany 535; Sweden 134.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous, including marble	132,667	131,105	Portugal 64,574; Yugoslavia 29,858.
Slate	1,190	1,361	West Germany 855; France 162; Portugal 142.
Other	44,321	57,106	Republic of South Africa 18,819; Norway 12,164; Sweden 9,421.
Worked, all types	1,062	893	Belgium-Luxembourg 187; Rumania 173; West Germany 157.
Dolomite	1,141	1,424	Norway 591; France 626.
Gravel and crushed rock	4,592	13,159	France 11,000.
Quartz and quartzite	57,012	41,490	West Germany 14,577; Switzerland 11,274; Portugal 7,898.
Sand, excluding metal bearing	697,296	845,291	Belgium-Luxembourg 396,941; France 296,884; Netherlands 127,962.
Sulfur:			
Elemental, all forms	85,523	78,359	France 36,990; United States 21,152; Canada 10,060.
Sulfur dioxide	232	217	West Germany 216.
Sulfuric acid	328	4,526	Yugoslavia 4,215.
Talc, steatite, soapstone and pyrophyllite	12,502	14,196	Austria 9,342; France 2,630.
Other nonmetals n.e.s.:			
Crude:			
Meerschaum, amber, jet	665	517	Canada 272; France 239.
Nepheline	1,415	3,741	Canada 3,718.
Slag, dross and similar waste, not metal bearing:			
From iron and steel manufacture.	4	4	France 3.
thousand tons			
Slag and ash n.e.s	3	3	Yugoslavia 2; France 1.
Oxides and hydroxides of magnesium, strontium, and barium.	954	507	United States 210; West Germany 162; United Kingdom 102.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen	2,611	3,353	United States 2,763.
Carbon black	20,209	24,215	United States 7,297; United Kingdom 5,074; France 4,949; Netherlands 4,363.

See footnotes at end of table.

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Table 3.—Italy: Imports of mineral commodities—Continued
(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS—Continued			
Coal and briquets:			
Anthracite and bituminous. thousand tons	10,691	11,813	United States 5,306; West Germany 2,978; U.S.S.R. 1,523; Poland 1,328.
Briquets of anthracite and bituminous coal. do	88	81	West Germany 65; France 10.
Lignite and lignite briquets do	233	274	West Germany 168; East Germany 44; Yugoslavia 31.
Coke and semicoke do	342	352	West Germany 240; Hungary 28.
Peat, including peat briquets do	9	11	West Germany 7.
Petroleum:			
Crude and partly refined do	76,140	86,439	Kuwait 24,185; Libya 15,878; Saudi Arabia 14,819; U.S.S.R. 10,620; Iraq 9,961.
Refinery products:			
Gasoline	104	98	Netherlands Antilles 27; U.S.S.R. 21; United States 14; United Kingdom 12.
Kerosine and jet fuel do	8	28	Trinidad and Tobago 8; Saudi Arabia 7.
Distillate fuel oil do	308	659	U.S.S.R. 294; Yugoslavia 103; Israel 59.
Residual fuel oil do	2,462	2,724	U.S.S.R. 975; Venezuela 308; Yugoslavia 288.
Liquefied petroleum gases do	11	87	Yugoslavia 11; Hungary 9; West Germany 8.
Lubricants, including grease do	101	125	United States 52; West Germany 22; France 18; Belgium-Luxembourg 13.
Mineral jelly and wax do	37	40	United States 10; West Germany 9; France 5; U.S.S.R. 4; Burma 4.
Other:			
Petroleum coke do	271	269	United States 250.
Bitumen and other residues. do	191	179	United States 141; Albania 21.
Mineral tar and other coal, or gas derived crude chemicals. do	55	66	Czechoslovakia 16; U.S.S.R. 15.

NA Not available.
[1] Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Output of primary aluminum was increased in 1968 by all three producing companies—Montecatini Edison S.p.A. (Montedison), Società Alluminio Veneto Anonima (SAVA), and Alcan Alluminio Italiano S.p.A. The rising output, which was expected to continue in 1969, appeared to be due to growing demand from the transportation and construction industries which together account for about 55 percent of the domestic market. Approximate production of primary metal in 1967 and 1968 by company and plant, and approximate productive capacity in 1968, are shown in the following tabulation:

Company and plant	Metric tons		
	Production		Annual capacity
	1967	1968	
Montedison:			
Mori	12,400	17,500	23,000
Bolzano	61,300	62,300	70,000
Subtotal	73,700	79,800	93,000
SAVA:			
Porto Marghera	27,700	30,300	33,000
Fusina	22,200	27,300	30,000
Subtotal	49,900	57,600	63,000
Alcan Alluminio Italiano:			
Borgofranco d'Ivrea	4,100	4,900	6,000
Grand total	127,700	142,300	162,000

Consumption of primary metal rose to 217,000 tons in 1968 (184,000 tons in 1967) and total consumption of aluminum rose to 323,000 tons (281,000 tons in

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1967). Imports of ingot and semimanufactures were little changed from 1967 levels, while exports were doubled to 68,000 tons. Imports of scrap dropped to 44,000 tons although output of secondary aluminum remained at approximately 100,000 tons.

Imports continued to compensate for declining production of bauxite in Italy. Imports totaled 586,000 tons in 1968. Yugoslavia remained the principal supplying country but deliveries from India, Indonesia, and Sierra Leone were substantially greater than in 1967.

In Sardinia, construction of an alumina plant and smelter [2] was reportedly underway. These facilities were expected to increase Italy's annual productive capacity by 600,000 tons of alumina and 100,000 tons of aluminum by 1971.

In other developments, Alcan Aluminium Ltd. planned to increase its interest in Angeletti e Ciucani S.p.A. to 66 percent, from the present 26 percent. The Italian firm is a leading semi-fabricator of aluminum, with an annual productive capacity of about 40,000 tons. Tubettificio Ligure S.p.A., the principal producer of aluminum containers and pipe, formed a partnership with a Yugoslav firm for production of containers in Yugoslavia. Montecatini Edison will act as technical consultant in Bahrein for the construction of a 90,000-ton-capacity aluminum smelter by Aluminium Bahrein.

Antimony.—The rising output of antimony was due to increased production at the Tafone open-pit mine, near Marciano in Tuscany. The mine was operated by Azienda Minerali Metallici Italiane (AMMI), the State company for nonferrous metals and the principal producer of antimony in Italy. Until 1967, most of the company's ore was mined in the Cagliari district of Sardinia but the Sardinian mines are now nearly exhausted.

The Tafone deposit contains about 550,000 tons of stibnite ore with an average antimony content of 3.3 percent. Total recoverable metal (in concentrate) was estimated at 11,900 tons, which is expected to supply Italian requirements for about 10 years.

Copper.—Trafilerie e Laminatoi di Metalli S.p.A. (TLM) completed a $4.8 million expansion program in 1968 which doubled the company's processing capacity for copper semimanufactures, to an estimated 80,000 tons annually. TLM operates plants at Milan, Brescia, and Genoa and is affiliated with Fiat S.p.A. and the French firm of Trèfimetaux.

AMMI, which had announced plans to build a 30,000-ton-per-year copper processing plant in Friulia, on the coast between Venice and Trieste, was considering increasing the capacity to 60,000 or 100,000 tons annually.

Exports of copper and alloys in 1968 increased to 41,000 tons. Total imports, including 42,000 tons of scrap and 199,000 tons of refined copper, were essentially unchanged. Consumption of refined metal was 226,000 tons in 1968, and total consumption of copper was 382,000 tons.

Iron and Steel.—A recovery in the domestic construction industry and strong foreign demand for Italian exports helped to push production and consumption of iron and steel to record levels in 1968. As compared with 1967 levels, both production and consumption of steel rose by approximately 1.1 million tons and net imports of steel were reduced by 600,000 tons. Mainly due to a predicted 15-percent increase in demand from the construction sector, steel consumption was expected to rise 4 to 5 percent, to about 18 million tons in 1969 and strong foreign demand was expected to persist in the heavy machinery, electronics, and automobile industries.

While there were no major increases in productive capacity during 1968, major expansions of facilities were initiated at the Taranto and Piombino steelworks, which will increase total capacity for iron and steel by approximately 2.5 million tons by 1972. The Taranto expansion reportedly involved an investment of $320 million.

Under an agreement between Italy and the Soviet Union, providing for economic and technical cooperation in metallurgy of iron, steel, and nonferrous metals, a program of exchange visits of Italian and Soviet experts was continued. At a meeting to be held at Rome in April 1969, items to be discussed included supplies of pelletized iron ore from the U.S.S.R., procurement of Italian machinery and plants, and possible Italian supplies of large-diameter (48- to 56-inch) gas line-pipe and special steel sheet.

[2] See Italy chapter of 1967 Minerals Yearbook.

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Table 4.—Italy: Salient statistics of the iron and steel industry

(Thousand metric tons unless otherwise specified)

	1967	1968
Production facilities:		
Furnaces (operating)[1]:		
Blast---units	13	13
Open-hearth---do	39	36
Electric---do	133	133
Maximum productive capacity:		
For pig iron	8,700	8,800
For steel	19,150	19,620
Production:		
Pig iron:		
Blast furnaces	7,052	7,619
Electric furnace	242	207
Total pig iron	7,294	7,826
Steel:		
Open-hearth	5,618	5,665
Electric furnace	5,997	6,427
Linz-Donawitz (LD)	4,272	4,869
Oil furnace	3	3
Total steel	15,890	16,964
Ingots:		
High carbon and alloy	1,843	2,004
Other	13,806	14,707
Castings	241	253
Consumption:		
Crude steel (apparent) kilograms per capita	320	349
Raw materials:		
For pig iron production:		
Iron ore, direct to furnaces	3,065	e 2,900
Iron ore, in agglomerating plants	7,575	e 8,650
Pyrite cinder, in agglomerating plants	130	e 220
Manganese ore	119	e 75
Coke:		
In agglomerating plants	462	e 505
In blast furnaces	3,877	e 4,000
Kilograms per ton of pig iron produced	530	e 512
For steel production:		
Iron ore	220	e 290
Scrap	10,144	e 10,500
Pig iron	7,169	e 7,900
Blast furnace ferro-alloys	83	e 85
Energy:		
Petroleum products	1,370	e 1,420
Gas thousand tons SCE [2]	2,734	e 2,700
Electricity million kilowatt-hours	10,337	e 11,000
Employment (December):		
Salaried---persons	11,250	[3] 11,270
Nonsalaried---do	56,433	[3] 55,950
Average direct hourly wage U.S. dollars	0.98	e [4] 1.02

e Estimate.
[1] July–September.
[2] Standard coal equivalent at 7,000 kilocalories per kilogram, calculated from units reported in billion kilocalories. Data includes natural and manufactured gas.
[3] September.
[4] April.

Sources: Associazione Industrie Siderurgiche Italiane (ASSIDER) (Milan). (*Association of Italian Iron and Steel Industries*). Rilevazioni Statistiche. Produzioni, 1967–68. Statistical Office of the European Communities (Luxembourg). (a) Iron and Steel, No. 6, 1968 and (b) Energy Statistics, No. 4, 1968.

Raw Materials.—Domestic production of iron and manganese ores was little changed from the levels of 1967. Output of conventional iron ore again declined slightly, to 708,000 tons, while output of manganese ore increased to 50,800 tons. Production of pelletized iron oxide, derived from pyrite processed at Scarlino by Montedison, was continued at the rate of about 350,000 tons annually. The pellets were delivered to the Piombino steelworks of Italsider S.p.A.

Imports of iron ore rose to 10,068,000 tons in 1968. Liberia continued to be the principal source although the quantity was 400,000 tons less than in 1967. Receipts from Canada and Mauritania declined by 10 and 20 percent, respectively, as compared with 1967, while increases of more than 300,000 tons were recorded from Brazil, Algeria, and the U.S.S.R.

Imports of manganese ore rose to 170,000 tons, with increased deliveries from Republic of South Africa, Australia, and the U.S.S.R. while shipments from mainland China declined by 10,000 tons.

Imports of chromite jumped to 163,000 tons in 1968, including 37,000 tons from Albania and an unusual shipment of 32,000 tons from Brazil.

An estimated 8.6 million tons of sinter and other agglomerates were produced at iron and steelworks in 1968. At the Cornigliano works, hydrated lime was being substituted for limestone in the agglomeration plant. Use of lime was reported to increase the output of agglomerate by 4 to 7 percent.

Scrap.—Imports of iron and steel scrap rose to 5,087,000 tons in 1968. The scrap was mainly obtained from France (1,890,000 tons), West Germany (1,710,000 tons), and the United States (571,000 tons). The quantity imported was slightly less than half of estimated consumption in steelworks. Consumption of scrap in Italy continued to be the highest in Europe, averaging more than 600 kilograms per ton of crude steel produced. Data on specific and total consumption of scrap follow:

Steelmaking process	Consumption of scrap (kilograms per ton of crude steel produced)	
	1966	1967
Converter	---	---
Open-hearth	512	535
Electric furnace	1,030	1,037
Other	244	240
All processes	628	645

Source: Economic Commission for Europe (ECE). Document St/ECE/Steel/26, "The European Steel Market in 1967."

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Area of use	Consumption of scrap (thousand metric tons)	
	1966	1967
Blast furnaces	31	48
Steelworks	8,520	10,144
Rolling mills	89	94
Steel foundries	38	47
Total	8,678	10,333

Source: Statistical Office of the European Communities (Luxembourg). Iron and Steel, No. 6, 1968; pp. 142–143.

A fragmentation plant to produce metallurgical scrap from old auto bodies was built at Sesto San Giovanni by an Italian firm in 1968. The plant can process 400 cars daily, and will draw its material from a radius of 100 to 150 kilometers, including areas of Switzerland. The scrap was expected to be used in electric and open-hearth furnaces of the Milan area.

"Proler" scrap, imported from the United States, was used successfully by Italian steelmakers in 1968. A trial shipment of about 15,000 tons was obtained in late 1967, and an additional 80,000 tons was ordered in the spring of 1968.

Pig Iron.—Italsider S.p.A. continued to account for the major share of pig iron production, with an output of 7,377,000 tons in 1968. Nazionale Cogne S.p.A. produced 243,000 tons at Aosta, and most of the remainder was produced by S.p.A. Acciaierie Ferriere Lombarde Falck (A. F.L. Falck).

Construction of new blast furnaces and improvements to existing plants continued to increase the nation's productive capacity in 1968. At Aosta, Cogne began operating a new blast furnace which had a daily productive capacity of 400 tons of pig iron, while the output capacity of No. 1 blast furnace was increased to 900 tons daily. At Trieste, Italsider completed rebuilding the No. 3 furnace, which raised the capacity of the Servola works to 600,000 tons of pig iron annually. At the same works, output capacity of the ingot mould foundry was being increased to 180,000 tons annually. In other Italsider plants, the hearth diameter of No. 2 blast furnace at Piombino was increased to 21.9 feet; No. 2 unit at Cornigliano was relined; and output capacity of No. 4 furnace at Bagnoli was being increased. The new blast furnace to be built at the Taranto steelworks will have a hearth diameter of 34.75 feet, possibly the world's largest. Italsider expects to increase its productive capacity for pig iron to 10 million tons annually by 1972.

Imports of pig iron and blast furnace ferroalloys in 1968 declined by 200,000 tons and $8.3 million in value as compared with 1967.

Crude Steel.—Production by Italsider plants in 1968 totaled 8,676,000 tons, 51 percent of the national output. Fifty-six percent of the company's output was produced in Linz-Donawitz (LD) converters, 42 percent in open-hearth furnaces, and 2 percent in electric furnaces. The company presently accounts for all LD production in Italy and for two-thirds of the open-hearth output. Company production, by plant, was distributed as follows:

Works	Crude steel (thousand metric tons)
Taranto	2,687
Cornigliano	2,190
Bagnoli	2,182
Piombino	1,241
Campi	284
Lovere	92
Total	8,676

Among other important producers, A.F.L. Falck increased output to 1.25 million tons, and an estimated 1.05 million tons was produced by Fiat S.p.A.

Capacity for oxygen steelmaking continued to increase in 1968. By yearend, Cogne had nearly completed construction of its oxygen steelworks at Aosta. The plant was expected to begin operating in the fall of 1969, and will nearly double the company's steelmaking capacity, to 450,000 tons annually. Italsider was dismantling open-hearth furnaces at Piombino, where three 80-ton LD converters will be installed by 1972. At that time, the output capacity at Piombino will have increased to 1.8 million tons annually, compared with 1.2 million tons in 1968. The new 300-ton converter for the Taranto steelworks was built in Genoa by S.p.A. Costruzioni Meccaniche Industriale Genovese, and was ready for shipment to Taranto by yearend. Steelmaking capacity at Taranto will increase to 4.5 million tons annually by 1972. By 1972, the total steelmaking capacity of Italsider is expected to be 11 million tons annually, with LD

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facilities making up 78 percent of the total capacity.

In electric steelmaking, Società Terni was building a 100-ton electric furnace which will increase productive capacity of the steelworks to 450,000 tons annually. Expansions of electric furnace capacity were being made by S.p.A. Breda Siderurgica and at the Rogoredo plant of S.p.A. Giuseppe e Fratello Redaelli. At Aosta, the Cogne company had nearly completed installation of an "Electro-Slag Remelting" plant, the first of its kind to be built in Italy. The plant was expected to begin operating in 1969.

In continuous casting, Società Terni continued construction of its new 150,000-ton-per-year facility for casting billets of stainless and silicon steel. A. F.L. Falck was planning to install a single-strand machine for slab at the Concordia works. By mid-1968 there were 16 continuous casting plants operating in Italy, with seven under construction and 18 planned.

Exports of crude forms of steel increased by 170,000 tons while imports declined by 150,000 tons, as compared with that of 1967. The principal commodity was coils.

Special Steels.—Production of carbon and alloy steel in 1968 was 2.1 million tons, approximately 12.4 percent of the total output of crude steel. The principal producing companies were Fiat, A.F.L. Falck, Terni, and Breda Siderurgica. The national output of special steels, by type, in the last 3 years was as follows, in thousand metric tons:

	1966	1967	1968
High carbon steel:			
Structural	693	809	895
Tool	3	3	3
Total	696	812	898
Alloy steel:			
Structural	657	779	858
Tool	21	31	25
Bearing	90	94	82
Stainless	187	210	233
High speed	2	2	2
Other	3	6	3
Total	960	1,122	1,203
Grand total	1,656	1,934	2,101

Source: ASSIDER (Milan). Rilevazioni Statistiche. Produzioni, 1966, 1967, and 1968.

Production of stainless steel, which was almost nonexistent in Italy in 1955, ranked about eighth in the world in 1968 and a further increase in production was expected in 1969. Exports of stainless steel semimanufactures were 42,000 tons in 1968, about 20 percent more than in 1967. Latest data available indicate that domestic consumption of stainless steel increased from approximately 50,000 tons in 1962 to 135,000 tons in 1966. Trends in consumption, by area of use, are given in the following tabulation:

Area of use	Percent of domestic consumption	
	1962	1966
Housewares and electric appliances	25	35
Chemical industry	37	12
Energy production	8	3
Municipal plants [1]	2	5
Building construction	4	4
Transportation	4	4
Unspecified	20	37
Total	100	100

[1] "Impianti per comunita."

Source: ASSIDER (Milan). Notiziario, No. 17, 1968, p. 27.

Società Terni, which accounted for about half of the total output of stainless steel in 1967, was investing $12 million to increase production capacity for hot-rolled coils to 55,000 tons annually in 1968 and 71,000 tons annually by 1972. The rolled products will be produced by Terninoss S.p.A., a subsidiary company formed jointly with United States Steel Corporation in 1964. The initial capacity of Terninoss S.p.A. was 30,000 tons of rolled products annually.

The Terni company was also investing $10 million to double its annual production capacity for magnetic sheet to 65,000 tons (oriented-grain) and 200,000 tons (non-oriented) by 1972.

Rolled Steel.—The Italsider Company produced 6,583,000 tons of hot-rolled steel and 1,454,000 tons of cold-rolled products in 1968. A.F.L. Falck produced 1.1 million tons of rolled steel, and Fiat S.p.A. "transformed" the equivalent of 1.95 million tons of steel ingots. Dalmine S.p.A. produced 740,000 tons of seamless tube and welded pipe.

At Taranto, production capacity for hot-rolled sheet was increased to 550,000 tons annually. Construction was started on a cold-rolling mill for sheet and strip, with a production capacity of 500,000 tons annually. The principal market for the cold-rolled products will be the Alfa-Sud auto-

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mobile plant, now under construction at Naples.

Società Cantieri Metallurgici Italiani S.p.A. produced 65,000 tons of tinplate, 16,000 tons of galvanized sheet, and 18,000 tons of thin sheet in 1968. During the year the company installed a new rolling unit, and expected to complete two new galvanizing lines by mid-1969. A second finishing mill was planned for completion by 1970. The new facilities will increase the company's production capacity for finished products to 220,000 tons annually.

La Magona d'Italia S.p.A. increased its production capacity for strip at Piombino to 140,000 tons annually.

Dalmine S.p.A. completed construction of a new pipeworks at Taranto. The plant has an annual production capacity of 80,000 tons of butt-welded pipe, in diameters from 6 to 20 inches, lengths from 20 to 59 feet, and thicknesses of 2.4 to 12.7 millimeters. The older pipeworks at Taranto was modified to enable the production of welded pipe 42 inches in diameter.

Exports of rolled steel increased by about 130,000 tons, while imports declined by 260,000 tons as compared with 1967 levels. Tubular products accounted for practically all of the increase in exports. Numerous pipeline construction projects at home and abroad were a major factor in the rising production and exports of pipe.

Trends in domestic consumption of some major items of rolled steel, from 1964 to 1968, are shown by the following tabulation (in thousand metric tons):

Item	Apparent consumption	
	1964	1968
Hot rolled:		
Bars and sections	3,164	4,731
Sheet (>3 millimeters)	1,147	1,651
Sheet (<3 millimeters)	232	99
Strip	615	883
Merchant bars and rods	611	835
Seamless tube	625	729
Railway materials	156	148
Wide plates	17	22
Terminal products:		
Cold rolled sheet	1,809	2,905
Welded pipe	364	715
Tinplate	255	330
Galvanized sheet	245	281
Magnetic sheet and strip	98	131

Source: ASSIDER (Milan). Notiziario, No. 7, 1969, pp. 1–7.

Lead and Zinc.—Output of lead concentrates dropped slightly in 1968, while production of zinc concentrates increased by 54,000 tons compared with 1967. Most of the increase in output of mine zinc came from oxidized ores mined in Sardinia by Monteponi-Montevecchio S.p.A., the principal producer of mine lead and zinc in Italy. Production of the ferruginous calamine concentrates, which contain about 22 percent zinc, was 88,000 tons, more than twice the quantity produced in 1967. The ore was processed at Monteponi in the Waelz furnace installed in mid-1967. The company completed the extensive reorganization of its mine and plant facilities in Sardinia, carried out since 1962 by the "Sartori" and "Faina" projects at a cost of some $75 million, and hoped to achieve a total mine output of 100,000 tons of lead and zinc in 1969. Smelter facilities include the Waelz furnace and electrolytic zinc plant at Monteponi, with an annual output capacity of 22,000 tons; a lead smelter and refinery at San Gavino Monreale, with annual output capacity of 36,000 tons; and a zinc plant at Porto Marghera near Venice, with annual production capacity of 40,000 tons. The zinc plants at Monteponi were used exclusively for calamine ores, and the sphalerite concentrates produced at Monteponi, Montevecchio, and Sos Enattos were shipped to Porto Marghera for smelting. Capacity of the zinc plants at Monteponi can be increased to 30,000 tons annually, and that of the lead smelter at San Gavino can be raised to 40,000 tons.

Società Mineraria e Metallurgica di Pertusola produced an estimated 30 percent of the lead and 25 percent of the zinc mined in Italy in 1968, mostly from the San Giovanni mine in Sardinia and the Salafossa mine in north Italy. The company also accounted for most smelter output of lead and zinc. Zinc production at Crotone was increased to approximately 50,000 tons, and lead production at La Spezia was estimated at 35,000 tons. Production capacity for lead at La Spezia was increased to 75,000 tons annually, by yearend.

Mine production by AMMI in 1968 was estimated at 30,000 tons of zinc and 3,000 tons of lead. Most of this output came from the Raibl mine in northeast Italy. The company was reported to be investing $1.8 million in exploration and development of the Raibl property in 1967–68.

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Raibl concentrate provided most of the feed to the company's electrolytic zinc plant at Ponte Nossa, north of Bergamo, where an estimated 25,000 tons of zinc was produced in 1968. The Ponte Nossa plant has been modernized with fluidized-bed roasting units, a new sulfuric acid plant and other improvements, and by year-end the annual output capacity was increased to 33,000 tons of zinc.

AMMI expected to begin construction of an Imperial Smelting plant at San Antioco, Sardinia, in 1969. Output capacity of the projected plant, when completed in 1971, was to be about 60,000 tons of zinc and 40,000 tons of lead annually, using domestic and imported concentrates. Ore supplies would be partly obtained through the West German firm of Metallgesellschaft. Contractors for the plant were reported to be Società Italiana Impianti, of Genoa, and Lurgi G.m.b.H. of West Germany. Construction of the smelter would increase the country's annual production capacity to 155,000 tons of lead and 172,000 tons of zinc. Consumption of primary metal in Italy in 1968 was 133,000 tons of lead and 155,000 tons of zinc.

Special tariffs on imports of lead and zinc into Italy, permitted by the EEC since 1961 to protect the Italian industry during the rationalization period, were scheduled to be reduced on January 1, 1968 and to end on June 30. The January 1 reduction, which required tariffs to be reduced by 60 percent toward EEC countries and by 25 percent toward other countries, was made in March after the EEC Commission denied Italy's request to delay the reduction until midyear. On June 30, the tariffs were to be lowered to zero toward EEC countries and to 8 lire per kilogram for lead and zinc from other countries, but this reduction was not made. The Italian Government asserted that it was essential to maintain duties of (per kilogram) 5 lire on zinc and 7 lire on lead from EEC countries, and 15 lire on zinc and 19 lire on lead from other countries, until the end of 1969. On September 13 the EEC Commission began proceedings to force the reduction but the matter appeared unresolved at yearend.

Except for scrap, which was obtained mainly from West Germany and France, EEC countries supplied about one-third of the zinc and 5 percent of the lead imported by Italy in 1967 and 1968. In 1968, imports of zinc metal and alloys dropped to 42,000 tons and imports of lead declined to 56,000 tons, while exports of both metals remained small. Imports of zinc concentrates increased to 26,000 tons, half of which came from Algeria, and imports of lead concentrate jumped to 54,000 tons owing to large shipments from Morocco and Ireland. Exports of zinc concentrate increased by one-third, as 10,500 tons were shipped to Republic of South Africa.

Mercury.—While production of both ore and metal increased in 1968, the average mercury content of ore appeared to decline to 0.52 percent as compared with 0.55 percent in 1967 and 1.2 percent 20 years earlier. Società Mineraria Monte Amiata, the principal producer, announced in early 1968 that development work and drilling had outlined better grade ore than was mined in 1967 and had increased the company's reserves. Development drifting on the (-) 200-meter level of the Abbadia mine was expected to be completed by yearend. Total length of the level was nearly 10,000 feet. In the Abbadia plant, increasing amounts of ore were being processed in the Gould furnaces to improve recovery of mercury. In the Morone plant, a second Pacific furnace, with a capacity of 50 tons daily, started production early in 1968.

Stabilimento Minerario del Siele, the second largest producer, reported a 10 percent increase in ore output during 1968 and was installing two new Pacific furnaces, each with a daily capacity of 50 tons, for service in October 1969. Four furnaces of the same type were already in production.

Reimposition of a production tax on mercury was reportedly proposed in 1968 but details were not available. A previous tax, amounting to about $140 per flask, was discontinued in 1961.

Exports of mercury in 1968 were 34,673 flasks. Shipments to the United States dropped by 7,000 flasks from the 1967 level. Deliveries to EEC countries and the United Kingdom declined, while exports increased to Japan, Poland, and East Germany.

NONMETALS

Construction Materials.—The recovery of the construction industry, which began in

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1967, gathered momentum in 1968, and there were significant increases in production, trade, and consumption of construction materials. Production of building stone, clay products and glass was 15 percent above the levels of 1967 while output of cement rose 12 percent. Exports of marble and other building and ornamental stone rose to more than 1 million tons, while decreased exports of cement and silica sand probably reflected the rise in domestic consumption. Imports of kaolin and other clays exceeded 1 million tons, and more than 800,000 tons of imported silica sand was added to already substantial domestic supplies. The high level of demand was expected to continue in 1969.

Cement.—With the 3.3-million-ton increase in output of cement in 1968, Italy continued to rank second to West Germany among West European producers. Utilization of plant capacity was estimated at 90 percent, compared with 83 percent in 1967 and 70 percent in 1965. Total productive capacity at yearend was reported to exceed 33 million tons annually. Despite increased cost of labor, fuels, transportation, and other production costs over the previous 7 years, Italian cement prices remained pegged at 1961 levels and were the lowest in Europe. The Italian Cement Association (Associazione Italiana Tecnico Economica del Cemento) (AITEC) continued to urge relaxation of price controls.

According to statistics published by AITEC, the Italian cement industry in 1967 included 73 companies and 116 plants. Eight plants produced more than 600,000 tons during 1967. Kilns totaled 248, including 175 rotary and 73 vertical, with total productive capacity of 31.5 million tons annually. Regional shares of total cement production were North Italy, 48 percent; Central, 17 percent; South, 23 percent; and Insular (Sicily, Sardinia, etc.), 12 percent.

At the Taranto cement plant of Cementerie del Tirreno S.p.A., automatic control of production was being increased in 1968 by the use of an IBM–1800 computer. The plant had a production capacity of 1.2 million tons annually.

Pyrite and Sulfur.—Output of pyrite at the Niccioleta and Gavorrano mines of Montecatini-Edison in Tuscany continued to rank Italy second to Spain in pyrite production in West Europe. About half of the mines' production was processed at Scarlino, yielding 700,000 tons of sulfuric acid and 350,000 tons of pelletized iron oxide. Eventually, the plant's capacity was expected to be increased, to process the entire mine output. A process to remove small quantities of copper, zinc, and other metals from the iron-rich residues was being developed by the company for installation in the Scarlino plant.

Large quantities of pyrite continued to be imported for production of sulfuric acid near Venice and at Priolo in Sicily. Imports totaled 1.1 million tons, including 720,000 tons from the U.S.S.R., 285,000 tons from Cyprus, and 79,000 tons from Turkey.

Government controls on the sale and importation of sulfur, in force since 1960, appeared to have been eliminated by mid-1968. The controls had been authorized by the EEC, to protect the Italian sulfur industry from foreign competition during its period of reorganization, and were scheduled to cease at yearend 1967. A request by the Government to continue the restrictions until mid-1968 was denied by the EEC Commission in February. The cessation of controls was accompanied by dissolution of the Italian Sulfur Agency (Ente Zolfo Italiani) (EZI).

All but two of the 18 remaining sulfur mines in Sicily were taken over in 1968 by Ente Minerario Siciliano (EMS), the mining agency of the regional government. Under the agency's plan to restructure Sicilian production, five more mines will be closed by 1971. EME expected to spend about $50 million on the reorganization program.

Three sulfur mines were operated on the mainland in 1968, two near Avellino and one near Catanzaro. The Avellino mines mainly produced ground sulfur ore for agricultural use, while the third was producing flotation concentrates in a new plant commissioned in 1967.

Imports of sulfur rose to 146,000 tons, 87 percent more than in 1967. The United States, Poland, and France supplied approximately 40,000 tons each, and 18,000 tons was obtained from Canada.

Salt.—Two large deposits of rock salt were being developed in 1968. Near Ciro, in Catanzaro Province, the Timpa del Salto deposit was being prepared for mining by

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Montedison. Production was expected to begin in 1970 at the rate of 1.5 million tons of salt annually. A 40-kilometer pipeline will carry the salt to processing plants. The salt is intended for chemical use.

In Sicily, a salt deposit near Realmonte, in Agrigento Province, was being developed for underground mining by a subsidiary of EMS. The International Salt Co. was acting as technical consultant. Excavation of the main gallery of the mine, which will be at a depth of 600 feet, was expected to begin early in 1969. Production was expected to begin in 1972, with a capacity of 2 million tons annually. Most of the salt will be used for the manufacture of chemicals, including highway antifreeze preparations. The cost of developing the mine and shipping facilities was reported to be $14 million.

In other developments, productive capacity of marine saltworks was being expanded at Margherita di Savoia, in Apulia Province, and at San Antioco, in Sardinia. The Apulian works had an annual output capacity of 600,000 tons by yearend. Both facilities are operated by the Government.

Other Nonmetals.—Production and apparent consumption of other important nonmetals such as asbestos, barite, bentonite, feldspar, fluorspar, and potassium salts increased in 1968. Exports of asbestos, bentonite, and talc were 15 to 25 percent above the levels of 1967, while imports of crude phosphate rose by 14 percent and imports of potassium salts (206,000 tons) were essentially unchanged. Exports of fluorspar (84,000 tons) were almost entirely destined for the United States.

MINERAL FUELS

Gross inland consumption of fuels in Italy in 1968 was estimated at 135 million tons of standard coal equivalent,[2] of which petroleum provided 69.2 percent, solid fuels 9.3 percent, natural gas 9.3 percent, hydroelectric power 11.7 percent, and geothermal steam and nuclear energy 0.5 percent. Domestic resources provided an estimated 23 percent of the energy consumed while imported fuels provided the remainder.

Coal and Coke.—Imports of coal declined slightly in 1968, to 11.7 million tons. The decline was due to reduced imports of anthracite, and gas and steam coals, as imports of coking coal rose to 8.4 million tons or 71 percent of the total receipts. The United States remained the principal supplier, although its share of the total dropped to only 33 percent as compared with 79 percent in 1965.

Output of coal from Italy's two remaining mines, in Sardinia, remained relatively low in 1968 and there was no indication as to when production might increase. The mines, which were recently modernized, had been scheduled to supply increasing quantities of coal to the 480-megawatt thermoelectric plant at Porto Vesme.

Consumption of coal in Italy for electric power generation probably increased in 1968 although the total consumption for all purposes may have declined due to the increasing use of fuel oil. Consumption in 1966 and 1967 was as follows, in thousand metric tons:

Consuming sector	1966	1967
Coking plants	8,017	8,042
Thermal powerplants	1,207	1,790
Gasworks	504	481
Railways	453	416
Other industry	585	417
Domestic and other	925	1,379
Total	11,691	12,475

Source: Organization for Economic Cooperation and Development (Paris). Statistics of Energy, 1953–67. 1969, pp. 178–180.

Consumption of coal in 1967 by thermal powerplants was 1 million tons more than in 1965. Four additional plants, capable of burning fuel oil or coal and having a total generating capacity of 1,160 megawatts, were scheduled to begin service in 1968. The La Spezia powerplant, a large consumer of coal, apparently reached its planned capacity of 1,800 megawatts by yearend.

Production of coke continued to rise as demand increased from the iron and steel industry, which normally accounts for about two-thirds of total consumption. Imports of coke totaled 300,000 tons and were mostly obtained from West Germany.

Italsider S.p.A. was building a new battery of 27 coke ovens at the Piombino steelworks. Production was expected to begin in 1970, at the rate of about 430 tons of coke daily. New coking facilities were also planned at Trieste and Taranto.

[2] At 7,000 kilocalories per kilogram.

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Nuclear Energy.—The Latina and Garigliano nuclear powerplants produced 2.6 billion kilowatt-hours of electricity in 1968. The Trino Vercellese plant, which has been closed since mid-1967, was expected to resume operation in 1969.

A plant for production of natural uranium fuel was being constructed in 1968 at Rotondella in south Italy, by Combustibili Nucleari S.p.A. Production was expected to begin in May 1969, and the plant will supply the Latina reactor with 80 tons of fuel over the next 3 years. Additional supplies of fuel for Latina will be provided by the United Kingdom Atomic Energy Authority (UKAEA), which is a joint participant in the Rotondella venture with Società Minerali Radioattivi Energia Nucleare (SOMIREN), a subsidiary of ENI. In another development, fuel elements containing 13 tons of uranium were delivered by Coren S.p.A. to the Trino Vercellese reactor in 1968. The elements were reported to be the first made in Italy. Coren is jointly owned by Fiat S.p.A. and the Westinghouse Electric Co.

Uranium requirements for Italy's nuclear energy program were estimated at 1,200 tons annually by 1975 and 3,500 tons by 1980. As very little uranium ore has been located in Italy, the Government was participating in uranium exploration in several foreign countries. In 1968, SOMIREN was prospecting in Somalia and in adjacent areas of Kenya, and also made an agreement with Denison Mines Ltd. of Canada for exploration in the northwestern United States.

Oil and Gas.—*Exploration.*—Offshore exploration in the north Adriatic Sea was conspicuously successful in 1968. Six gasfields—four in Zone A and two in Zone B—were discovered, which increased Italy's reserves by approximately 60 billion cubic meters, nearly 50 percent more than the total known on January 1. In Zone A, a new field was found in ENI's Cervia Mare concession and three others were found by the ENI-Shell partnership (owned 51 percent by ENI and 49 percent by Shell Italiana S.p.A.). The discoveries in Zone B were made by Elf Italiana Mineraria, a company owned by the French Government. Many other companies were exploring or had applied for concessions in both zones by yearend. ENI, which by law is entitled to choose 25 percent of all Italian offshore areas for its exclusive concession, had chosen its areas in Zones D and E and completed preliminary geophysical surveys of all 5 zones of the continental shelf by yearend. Zones D and E were to be opened to bidding by March 1969 and Zone C (Sicily) by the following October.

The 1968 discoveries greatly improved Italy's gas supply position and gave the Government more time to consider proposed supply contracts with foreign producers such as the U.S.S.R., the Netherlands, and Algeria. Under a previous contract, deliveries of liquefied natural gas from Libya were scheduled to start in 1969 at the rate of 3 million normal cubic meters annually.

In foreign exploration, important discoveries of gas were made by ENI in Egypt and in the British and Norwegian sectors of the North Sea.

Gas Pipelines.—Gas pipeline construction continued at an accelerated pace, and more than 6,500 kilometers of natural gas pipeline were in service by yearend. Società Nazionale Metanodotti Progetti S.p.A. (Snam Progetti), a major pipeline builder and a subsidiary of ENI, completed about 600 kilometers of pipeline in Italy in 1968 and several hundred kilometers more were under construction. The main project begun in 1968 was a 310-kilometer, 26-inch line to link Ravenna and Chieti on the Adriatic coast. From Panigaglia, near La Spezia, pipelines for distribution of Libyan gas to north and central Italy were in advanced stages of construction and will be completed to Livorno and Florence by the end of 1969.

Large gas pipeline contracts were negotiated by Snam Progetti in Algeria and Australia. The company completed 2,400 kilometers of oil and gas lines in 1968 and reportedly won 25 percent of all pipeline contracts awarded in noncommunist countries.

Petroleum.—*Crude Oil.*—Imports of crude oil were 87 million tons in 1968, including more than 20 million tons from Libya. Compared with those of 1967, imports from Libya rose by one-third while imports from Kuwait declined by a similar proportion. Deliveries from Iraq and Saudi Arabia fell by 6.6 million tons and 3 million tons, respectively. Imports from the U.S.S.R. increased slightly, to 11 million tons.

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Crude oil production by ENI included 1.5 million tons in Italy and about 5 million tons in other countries, mainly Tunisia. New discoveries were reported in Libya, Iran, and Nigeria. The Libyan strike, made in late 1967, appeared to have the largest production potential but was still being evaluated at yearend.

A contract for the purchase of $1 billion worth of Libyan crude oil was negotiated in December by the Italian firm Società Industriale Catanese (SINCAT) with the Occidental Petroleum Corp. of Los Angeles, Calif. The crude oil was to be used mainly for manufacture of petrochemicals. SINCAT is a subsidiary of Montecatini Edison S.p.A.

Refining.—The 30-percent reserve capacity, required for many years in Italian petroleum refineries, was apparently abolished early in January 1968. This move increased the authorized refinery capacity to nearly 130 million tons annually, including about 18 million tons capacity in petrochemical plants. An additional 20 million tons of refinery capacity was expected to be installed by 1972.

Refinery throughput in 1968 included about 88 million tons of crude oil and 6 million tons of partially refined crude. Consumption of petroleum products increased about 12 percent to 54 million tons while net exports increased to about 23 million tons.

The principal gains in domestic consumption were registered in gasoline, diesel oil, and residual fuel oil. An increase of about 20 percent in consumption of distillate fuel oils was partly due to antipollution restrictions which forbade the burning of residual fuel oil in smog-prone areas. Approximate consumption of petroleum products in 1967 and 1968 was as follows, in thousand metric tons:

Product	Consumption	
	1967	1968
Gasoline	7,181	7,900
Jet fuel	345	380
Kerosine	851	1,100
Distillate fuel oil	4,857	6,000
Residual fuel oil	30,700	34,000
Liquefied petroleum gas	1,360	1,400
Lubricants	1,340	1,450
Other (estimated)	1,566	1,770
Total	48,200	54,000

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The Mineral Industry of Japan

By Ta Cheng Li [1] and R. A. Pense [2]

Japan's mineral industry strengthened its high ranking in the world in 1968 principally by processing greater amounts of foreign raw materials. In terms of value of indigenous crude mineral output and value added by processing, the minerals sector was estimated to have contributed about $7 billion to the national economy. This would have constituted about 5.2 percent of a preliminarily estimated gross national product (GNP) of slightly over $135 billion in nominal prices. In both GNP and overall industrial output, Japan ranked third in the world in 1968.

Mineral processing, led by iron and steel manufacturing, nonferrous metal production, and fuels treatment, probably outweighed by at least 5 to 1 mining, which was paced by coal and lignite extraction. Indexes of the overall mining sector and components of manufacturing identified with mineral processing were as follows (1965 = 100):

	1967	1968
Mining	104.3	105.3
Iron and steel	149.6	168.4
Nonferrous metals	135.9	162.9
Petroleum and coal products	138.2	158.3
Ceramics (including cement and refractories)	r 127.5	144.4
Chemicals (including chemical fertilizers and petrochemicals)	132.3	153.3

r Revised.

According to a Ministry of International Trade and Industry (MITI) survey conducted in September, investment in industrial plants and equipment under its jurisdiction was expected to be about $8.1 billion in fiscal 1968 (April 1968-March 1969), a 34 percent increase over the previous fiscal year's investments. In the mineral-related industries, investments were estimated at approximately $3.0 billion, a planned overall increase of 42 percent. Projected investments by the component sectors of the minerals industry in fiscal 1968, in million dollars and percentage change over the previous fiscal year's outlay were as follows:

Sector	Investment	Percent change
Iron and steel	$1,248	+31
Petroleum refining	727	+47
Petrochemicals	591	+93
Cement	158	+62
Nonferrous mining and smelting	114	+23
Coal	91	+2
Ammonium sulfate	85	−1

Iron and steel investments were reportedly centered on producing more items for export, while petroleum refining and nonferrous mining and smelting outlays were principally for meeting rising domestic demand. Rationalization of existing plant equipment was allegedly an important incentive in cement investment.

Restrictions on foreign capital investment and management participation in Japanese businesses received mounting overseas criticism. Although a number of mineral producing or processing sectors were known to be under consideration for capital liberalization in early 1969, apparently none of particular interest to foreign investors (such as offshore oil production) were included. At present foreign participation in the minerals industry is limited chiefly to the petroleum, aluminum, and petrochemicals sectors.

Japanese petroleum companies with foreign affiliations accounted for 50 to 60 percent of domestic refining and marketing in 1968. The principal foreign participants were Esso Standard Eastern Inc. and Mobil Petroleum Co., Inc. (combined);

[1] Mining engineer, Division of International Activities.
[2] Research specialist, Division of International Activities.

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California Texas Oil Corp.; and Royal Dutch/Shell affiliates. In 1968 foreign investors, mainly petroleum companies, loaned about $103 million to Japanese petroleum companies. All of the primary aluminum producing concerns had foreign connections. Aluminum Company of Canada, Ltd., held a 50-percent interest in Nippon Light Metal Co., Ltd., Japan's largest producer, and supplied technology. France's Pechiney, Compagnie de Produits Chimiques et Électrométallurgiques, had technological agreements with the three other producers, and was making a similar arrangement with another company entering the field. Foreign participation in the form of capital and technology was even more extensive in the aluminum rolling sector: Aluminum Company of America, Kaiser Aluminum & Chemical Corp., Reynolds Metals Co., and Swiss Aluminium Ltd. were all involved. Foreign (largely U.S.) technology, and to a lesser extent capital, also was of importance in the petrochemical industry.

Development continued during 1968 of the 70 to 80 million tons of "kuroku" (black) ore reserves found during the past decade in the northern part of Akita Prefecture in northern Honshu. At yearend there were 10 mines producing almost 200,000 tons per month of this ore containing an average 2.5 percent copper, 1.0 percent lead, and 4.0 percent zinc, as well as gold and silver values and substantial amounts of recoverable pyrite. Together, these pits supplied about 40 percent of Japan's 1968 mine copper and 25 percent of its mine lead and zinc, more than compensating for declining output of the major nonferrous metals from more conventional deposits. Three of the "kuroku" ore mines —Dowa Mining Co., Ltd.'s Hanaoka and Kosaka pits and the Shakanai mine of Nippon Mining Co., Ltd. (Nippon Mining) —accounted for about 75 percent of the metallic output of "kuroku" ore.[3]

The Government's Metallic Minerals Exploration Agency (MMEA) announced the discovery in 1968 of two new deposits of "kuroku" ore in Fukushima Prefecture, northern Honshu. The two deposits, one of which reportedly has 2 to 3 million tons of ore, were found in the general vicinity of Nippon Mining's Yoshino mine, until now the only pit outside of Akita Prefecture producing "kuroku" ore. These latest discoveries were the result of a 10-year Government program initiated in fiscal 1966 (April 1966–March 1967) to develop additional indigenous reserves of copper, lead, zinc and manganese. Twenty-eight areas considered favorable for exploration have been designated for three-stage investigation: Regional geological survey; detailed geological exploration; and intensive examination. The first two stages are entrusted to MMEA, which at yearend 1968 was conducting regional surveying in 11 areas and detailed exploration in three others. The third stage is the responsibility of private mining companies, which at yearend were carrying out intensive examinations in two areas.

With Japanese output of refined copper, aluminum, and zinc projected to reach the 1-million-ton-per-year level by the early or middle 1970's, metal producers were aggressively seeking more overseas raw material supplies in 1968. Copper refiners were particularly successful, concluding important agreements for shipments of concentrates from Australia, Canada, and the Philippines containing a yearly aggregate of 80,000 tons of copper. Other ventures were under negotiation in Canada, Chile, Indonesia (West Irian), and the Solomon Islands (Bougainville) which could result in an additional 220,000 tons annually of copper-in-concentrates being obtained from abroad. In addition to expanding contracts with existing bauxite suppliers in Australia and Indonesia, aluminum producers were negotiating the purchase of up to 1 million tons of bauxite per year from a new source in Australia and surveyed resource potential in India and Thailand. Interest was also expressed in developing bauxite deposits in the West African countries of Ghana and Guinea. Sumitomo Metal Mining Co., Ltd. (Sumitomo Metal), one of the major nonferrous metal producers, joined two separate consortiums in 1968 whose objectives were to explore for copper and other minerals in Australia.

Ferronickel makers tentatively initiated two agreements to explore for nickel reserves in Indonesia with a view towards maximum development. Chromite users examined deposits in Iran and manganese consumers, ore bodies in India. Mercury producers visited Indonesia, Malaysia, and Turkey in search of new ore supplies. A mission representing the Society of Newer Metals toured India and Africa. Potential

[3] Mining Engineering. V. 21, No. 5, May 1969, pp. 60–65.

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new sources of rare minerals alleged to have been uncovered during the trip included India for beryllium, the Congo (Kinshasa) and Uganda for tantalite, Mozambique for both beryllium and tantalite, and the United Arab Republic for monazite.

In many of their overseas activities, the private Japanese concerns were being assisted by MITI. MITI estimated that to obtain foreign copper alone at least $400 million would have to be spent by 1975, and extended in fiscal year 1968 $28 million in low-interest, medium-term loans to four companies exploring for copper, lead, or zinc at seven projects in Australia and Canada. The principal arm of MITI abroad is now MMEA, formerly charged only with domestic resource investigation. In 1968 many of the activities formerly carried out by the quasi-Government Overseas Mineral Resources Development Co., Ltd. (OMRDC) were apparently transferred to MMEA and new functions, such as approving loans to private companies for overseas exploration, added. OMRDC is expected to continue operations, but more as a developer than a surveyor of foreign mineral resources. Permanent regional offices of MMEA, which in 1968 conducted exploratory activities in Chile and the Congo (Kinshasa), are to be established in Bangkok, Thailand, and Canberra, Australia.

Plans for offshore minerals development moved forward rapidly in 1968. The Government-owned Japan Petroleum Development Corporation (KODAN) joined in April with a group of seven private companies, most of which were associated with the Mitsubishi industrial combine, to form the Japan Offshore Drilling Co., Ltd., to produce drilling equipment and provide services for Japanese petroleum explorers overseas. The first piece of equipment, a jack-up barge, was completed in December for use by Japex Indonesia, Ltd., off eastern Kalimantan. The Mitsui industrial combine established the Mitsui Ocean Development and Engineering Co., Ltd., in December to serve the same purposes as Japan Offshore, and Sumitomo Trading Co., Ltd., apparently was still negotiating at yearend with Ocean Systems, Inc., of the United States for a similar venture. Under the impetus of these developments, the Science and Technology Agency announced near the close of the year that, following earlier recommendations of the Council for Ocean Science and Technology (an advisory body to the Prime Minister), it would soon initiate a comprehensive 3-year research program in the Sea of Japan. The Agency spent about $107,000 on this activity in fiscal 1968.

The Oceanic Development Committee (an advisory organ of MITI) prepared near yearend a report showing that Japan's present offshore drilling capacity was limited to depths of 30 meters not more than 3 kilometers from land. This allegedly placed Japan far behind other countries—particularly the United States—in this respect and brought the recommendation that a special center be established to bridge this "technological gap." Meanwhile, the West Japan Petroleum Development Co., Ltd., formed in August by the Mitsubishi combine and Royal Dutch/Shell affiliates to explore the Tsushima Straits area of the Sea of Japan, conducted an aeromagnetic survey of 24,000 square miles off the coasts of southwestern Honshu and southwestern Kyushu. KODAN joined in October with Idemetsu Kosan Co., Ltd., to explore seismically the shelf off Akita Prefecture in northwestern Honshu, using new "air-gun" equipment purchased in the United States. Previously, Idemetsu Kosan, two other Japanese petroleum companies and Standard Oil (Indiana) had completed a joint aeromagnetic survey off the shore of five northwestern Honshu prefectures (including Akita).

A new and stricter national air pollution law was passed in 1968, establishing for the first time controls over sulfur dioxide emissions. Covering gases from both automobiles and chimneys, the law also initiated the principles of *a priori* regulation, controls varying with the height of the vent, special standards for more critical areas of congestion, and consultation with local authorities. Municipal officials in Tokyo were critical of the new law, however, pointing out that their own standards were already more stringent than those of the new legislation.

The largest and most far-reaching merger project in recent years, not only in the minerals industry but the entire industrial structure—the amalgamation of Yawata Iron and Steel Co., Ltd., and Fuji Iron and Steel Co., Ltd., Japan's two largest steel companies, into an entity second only to United States Steel Corp.—made slow progress throughout 1968 toward its mid-

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1969 target date. Among the potential advantages claimed for the merger by the Industrial Structure Council, a consultative organ to MITI, were: a lowering of costs resulting from the rationalized movement of raw materials to and products from the scattered plants of the two firms; more efficient use of the capacity at their existing facilities; an enlarged scale of management needed to cope with the proliferation of 10- to 12-million-ton-per-year steel plants; an avoidance of future equipment duplication; and a pooling of research funds for such expensive projects as continuous casting. Virtually all of the country's other steel producers, including the closest competitiors of Yawata Steel and Fuji Steel, were supporting the merger as a means of stabilizing both the volatile internal Japanese steel market and their international trade in steel.

Initiative passed from MITI and the two principals, however, to the Fair Trade Commission, which was mainly concerned with preventing the proposed new company from monopolizing the production of rails, tinplate, sheet pilings and cast iron. If these details are eventually worked out, the new concern will take the name of New Japan Iron and Steel Co., Ltd. The paidup capital of New Japan ($636 million) would be roughly only 40 percent that of U.S. Steel, and its labor force (81,000) allegedly would be less than one-half.

PRODUCTION

The value of mineral industry output in 1968 was estimated to be about $7 billion. The corresponding estimate for 1967 was $6.5 billion. As reported by official Japanese sources, total mining output value in 1967 (the most recent year for which these data are reported) was about $944 million. Coal and lignite mining contributed $491 million, metal mining $243 million, nonmetallics mining $157 million, and crude oil and natural gas production $53 million. The most important metals by far were copper ($120 million) and lead and zinc ($51 million). Limestone ($73 million) was clearly the most significant nonmetal. Overall, the officially recorded output value of the mining sector increased only about 11 percent during 1964–67 while GNP climbed 50 percent. Increases in metal mining (up 24 percent) and nonmetal extraction (up 28 percent) offset a 4-percent decrease in coal and lignite production during this period.

Largely excluded from official mine output data but included in U.S. Bureau of Mines estimates is the very substantial value of stone and sand and gravel for construction use.

Preliminary official Japanese data for the value added in 1967 by some of the important mineral processing sectors showed $2,805 million by the iron and steel industry, $952 million by the nonferrous metal processing industry, and $370 million by the fuels processing industry. In contrast to mining, the combined added value of these three sectors kept pace with the GNP growth during 1964–67.

Included in Bureau of Mines estimates for total mineral industry output value, but not available from official Japanese data for comparable dates, are considerable added values contributed by chemical fertilizers, petrochemicals, cement, and refractories.

Compared with other countries in 1968, Japan's production of steel ranked third after the United States and U.S.S.R. and was almost equal to the combined total of the next two countries. It was also third rated in special steels and ferroalloys. In primary nonferrous metal smelting and refining, the country placed approximately as follows: Aluminum (4th), bismuth (2d), cadmium (3d), copper (5th), lead (6th), magnesium (6th), titanium (2d), and zinc (3d). In mine production of metals, it ranked less highly, although holding seventh to 10th position as an extractor of copper, gold, mercury, silver, tungsten, and zinc.

Japan led the world in producing pyrites and talc-soapstone-pyrophyllite, and remained the third largest producer and exporter of cement. In output of nitrogenous fertilizers, it probably ranked second. The country apparently became the fourth largest petroleum refiner during the year, surpassing West Germany, and remained the fourth largest coke producer. Domestic coal and lignite production, while still substantial and of considerable importance in the indigenous mining industry, fell well outside the world's 10 largest outputs and provided only about 14 percent of the country's primary energy needs.

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Table 1.—Japan: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Alumina, gross weight	626	656	690	748	826
Metal:					
Primary	266	294	337	382	482
Secondary	108	124	140	176	227
Antimony:					
Mine output, metal content—tons	156	57	24	17	19
Metal—do	2,324	1,411	r 1,981	r 2,703	2,678
Arsenic, white—do	499	479	547	643	686
Bismuth, metal—do	506	611	r 550	634	724
Cadmium, metal—do	1,215	1,480	1,756	1,899	2,195
Chromium:					
Chromite	44	42	33	45	9
Metal—tons	976	1,090	611	1,325	1,212
Cobalt, metal—do	16	4	-------	-------	-------
Columbium and tantalum, metal, tantalum—do	11	r 7	7	12	11
Copper:					
Mine output, metal content	106	107	r 112	118	120
Metal, refined:					
Primary	342	366	405	470	548
Secondary	118	122	115	148	176
Germanium:					
Oxide recovered—tons	21	22	14	23	NA
Metal—do	24	18	15	21	25
Gold, metal—thousand troy ounces	460	519	555	678	733
Indium, metal—do	229	281	273	r 561	563
Iron and steel:					
Iron ore and concentrate	2,557	2,510	2,399	r 2,213	2,171
Roasted pyrite	1,926	1,965	2,021	r 2,033	1,985
Pig iron	23,778	27,502	32,018	40,095	46,397
Ferroalloys:					
Ferrochrome	137	117	137	197	214
Ferromanganese	212	221	237	303	344
Ferronickel	78	74	72	107	134
Ferrosilicon	114	121	139	146	167
Silicomanganese	• 115	• 115	r 126	r 176	190
Other [1]	4	3	4	5	5
Steel, ingots and castings	39,799	41,161	47,784	62,154	66,892
Steel semimanufactures, hot rolled:					
Ordinary	29,381	30,972	35,760	45,934	50,509
Special	2,532	2,412	3,196	4,426	5,178
Lead:					
Mine output, metal content	54	55	63	r 63	63
Metal:					
Primary	97	108	119	150	165
Secondary	61	57	60	36	42
Magnesium, metal, primary—tons	2,937	3,785	5,291	6,748	5,657
Manganese:					
Ore and concentrate, gross weight	285	303	321	r 339	323
Metal—tons	5,814	5,567	4,657	6,333	7,036
Mercury:					
Mine output, metal content—76-pound flasks	r 4,971	r 4,688	r 4,845	r 4,616	5,046
Metal, primary—do	10,375	9,415	9,072	8,690	7,674
Molybdenum:					
Mine output, metal content—tons	281	277	246	256	286
Metal—do	146	105	142	204	202
Nickel, metal, primary—do	6,673	r 6,301	7,182	7,407	6,589
Platinum-group metals, metal:					
Palladium—troy ounces	1,875	2,952	5,495	3,327	4,034
Platinum—do	2,199	2,466	2,733	3,072	2,772
Rare-earth metals, cerium—tons	164	127	153	90	74
Selenium, elemental—do	148	158	r 191	191	181
Silver:					
Mine output, metal content—thousand troy ounces	8,715	8,989	10,319	10,800	10,713
Metal, primary—do	15,966	r 16,673	18,327	22,173	27,874
Tellurium, elemental—tons	3	9	10	13	14
Tin:					
Mine output, metal content—long tons	796	837	971	r 1,166	927
Metal, primary—do	1,954	1,610	1,836	1,666	1,857
Titanium, metal—tons	2,993	4,840	6,432	7,840	5,428
Tungsten:					
Mine output, metal content—do	413	344	328	391	529
Metal—do	703	622	675	1,004	1,141
Zinc:					
Mine output, metal content	216	221	253	r 263	264
Metal, primary	316	368	444	516	606
Zirconium, metal—kilograms	66	102	60	33	39
NONMETALS					
Asbestos	16	15	19	r 25	22

See footnotes at end of table.

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Table 1.—Japan: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Barite	40	42	40	38	55
Bromine, elemental tons	4,681	3,962	5,056	6,002	6,330
Cement, hydraulic	32,981	32,689	38,265	42,993	48,009
Clays:					
Fire clay	920	1,011	1,042	r 1,420	1,964
Kaolin	107	89	118	150	174
Feldspar (including feldspar substitutes)	317	336	344	r 372	405
Fertilizer materials:					
Crude, potash, gross weight	8	7	10	12	15
Manufactured:					
Nitrogenous, nitrogen content e	1,348	1,513	1,711	1,885	2,000
Superphosphates	1,661	1,550	1,191	1,195	1,147
Fluorspar, all grades	19	17	14	r 15	16
Graphite (mostly cystalline) tons	2,450	2,252	2,203	r 1,715	1,489
Gypsum	751	650	598	r 584	562
Iodine, elemental tons	2,025	2,193	2,627	2,910	3,591
Lime (quicklime)	1,631	1,692	2,013	3,082	3,625
Pigments, natural mineral:					
Antimony oxide tons	1,615	1,129	1,368	1,861	2,142
Manganese oxide	12	21	23	r 34	32
Titanium slag tons	1,960	2,894	3,508	5,709	4,195
Zinc oxide	35	36	39	42	52
Pyrite, pyrrhotite (including cupreous), gross weight	4,146	4,323	4,734	r 4,528	4,475
Salt, all types	893	848	850	973	967
Stone, sand, and gravel, n.e.s.:					
Crushed and broken:					
Dolomite	r 1,835	1,674	1,711	r 2,144	2,226
Limestone	r 60,701	61,363	71,450	r 81,719	91,629
Stone, not further described (silica stone)	2,999	3,049	3,112	r 4,075	5,478
Sand (including glass sand)	2,129	2,316	2,589	r 3,332	3,669
Sulfur, elemental:					
Native, other than Frasch	241	213	230	254	260
Byproduct (recovered from petroleum products)	19	37	53	62	74
Sulfuric acid	5,372	5,655	6,031	6,280	6,591
Talc and related minerals:					
Pyrophyllite	957	915	1,004	1,250	1,545
Talc	98	93	r 105	r 130	144
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	111	123	135	176	219
Coal:					
Anthracite	1,709	1,630	1,612	1,514	1,489
Bituminous [2]	49,220	47,904	49,736	45,532	45,079
Lignite	691	573	452	366	335
Coke:					
From coke ovens	13,697	r 15,777	r 17,818	r 22,171	25,070
From gas plants	3,721	3,670	3,713	4,165	4,470
Fuel briquets, all grades	4,082	3,918	4,054	3,839	3,802
Gas:					
Natural:					
Gross production [3] million cubic feet	65,640	62,861	64,509	66,734	72,617
Marketed do	64,317	60,982	62,733	65,634	NA
Natural gas liquids:					
Natural gasoline thousand 42-gallon barrels	228	58	29	28	33
Liquefied natural gas do	604	648	669	654	559
Liquefied petroleum gas (from natural gas):					
From field plants do	164	162	131	142	138
From petrochemical plants do	6,811	11,632	16,111	18,545	24,861
Peat e	70	70	70	70	70
Petroleum:					
Crude oil thousand 42-gallon barrels	r 4,597	r 4,698	r 5,443	r 5,520	5,476
Refinery products:					
Gasoline, aviation and motor do	62,507	68,611	79,225	90,806	103,121
Naphtha do	31,142	45,929	56,819	67,649	87,983
Kerosine do	28,395	34,922	39,808	54,394	65,919
Jet fuel do	6,344	8,105	9,425	15,340	18,726
Distillate fuel oils do	50,730	56,747	69,778	81,450	97,630
Residual fuel oil do	228,133	262,591	313,143	382,061	429,470
Liquefied petroleum gas r do	17,088	20,328	22,668	26,548	30,134
Lubricating oils do	6,758	7,273	8,234	9,348	10,690
Greases do	237	243	267	297	322
Asphalt and bitumen, refinery do	7,867	9,207	11,368	12,507	15,114
Petroleum coke do	464	456	411	396	448
Paraffin do	526	536	643	r 693	787
Refinery fuel [4] do	10,735	13,146	15,128	17,554	e 21,000

e Estimate. r Revised. NA Not available.

[1] Includes ferromolybdenum, ferrotungsten and ferrovanadium.

[2] Includes small amount of natural coke.

[3] Includes small amount of coal mine gas.

[4] Excludes natural and refinery gas.

Sources: Ministry of International Trade and Industry. Mining Yearbook of Japan, 1964–67; Yearbook of Petroleum Statistics, 1964–67; Yearbook of Coal and Coke Statistics, 1964–67; Petroleum Statistical Weekly, issue 44–1.

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TRADE

Total commodity trade rose again in 1968 to $25,959 million, with both exports (up 24 percent) and imports (up 11 percent) reaching new highs. Overall mineral trade increased to a record $7,820 million, as exports increased 22 percent to $2,184 million and imports 10 percent to $5,636 million. Total commodity trade was virtually in balance. Although the mineral trade deficit of $3,452 million appeared quite unfavorable, exports of manufactured metallic products such as ships, automobiles, and industrial machinery compensated for most if not all of the imbalance. The key iron and steel industry showed a favorable balance during the year on the more conventional basis of exports of primary and semimanufactured products weighed against imports of raw materials.

By far the most important mineral exports were iron and steel products, unofficially valued at $1,812 million. Nonferrous metals ($162 million), fertilizers ($73 million), and nonmetallic mineral manufactures ($61 million including $27 million of cement) accounted for most of the remainder. The most significant mineral imports were mineral fuels and lubricants valued at $2,675 million. Of this total crude and partly refined oil accounted for $1,685 million, petroleum products $415 million, and coking coal $492 million. Approximately $1,649 million of metalliferous ores and scrap, including $834 million of iron ore, $158 million of iron and steel scrap, and $271 million of copper concentrates, were imported. Imports of nonferrous metals and alloys, the third major category of mineral imports, amounted to $647 million, of which $358 million was copper and alloys.

The United States was Japan's largest trading partner in both overall trade and mineral commodities. It accounted for about 32 percent and 27 percent, respectively, of all commodity exports and imports, and approximately 42 percent and 14 percent, respectively, of mineral exports and imports. Iron and steel products, unofficially valued at $878 million, constituted the largest part of the $908 million of Japanese mineral commodities exported to the United States. The most important of the $763 million of minerals imported from the United States were coking coal ($268 million) and iron and steel scrap ($118 million).

The following tabulation summarizes Japanese mineral and total commodity trade for 1966–68:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1966	1,815	9,776	18.6
1967	1,792	10,442	17.2
1968	2,184	12,972	16.8
Imports:			
1966	3,791	9,523	39.8
1967	5,129	11,663	44.0
1968	5,636	12,987	43.4
Trade balance:			
1966	−1,976	+253	XX
1967	−3,337	−1,221	XX
1968	−3,452	−15	XX

XX Not applicable.

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Table 2.—Japan: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity		1966	1967	1968	Principal destinations, 1967
METALS					
Aluminum:					
Oxide and hydroxide		120,899	89,000	28,778	United States 44,830; Australia 28,073.
Metal, including alloys, all forms		50,396	21,490	35,264	United States 6,271; Hong Kong 2,201.
Bismuth, metal, including alloys, all forms		91	230	46	Netherlands 81; France 61; United States 49.
Cadmium, metal, including alloys, all forms		659	565	708	Netherlands 226; United States 112.
Copper, metal, including alloys, semimanufactures		39,744	33,635	43,015	United States 7,634; Hong Kong 4,401; mainland China 3,884; Taiwan 3,785.
Iron and steel, metal:					
Ferroalloys:					
Ferrochrome		22,256	6,328	5,604	United States 1,972; United Kingdom 1,350.
Ferromanganese		15,046	4,812	7,157	United States 2,532; South Korea 687.
Others		2,585	3,774	6,648	United States 2,455.
Steel primary forms	thousand tons	1,025	810	1,249	United States 523; Belgium 60.
Semimanufactures: Bars, rods, angles, shapes and sections:					
Wire rod	thousand tons	741	659	854	United States 392.
Other bars and rods	do	550	988	599	United States 148.
Angles, shapes and sections	do	544	378	556	United States 194.
Universals, plates, and sheets:					
Universals and heavy plates, uncoated	do	854	763	1,357	United States 341; South Korea 62.
Medium plates and sheets, uncoated	do	378	409	559	United States 218, mainland China 73.
Light plates and sheets, uncoated	do	2,274	2,557	3,658	United States 1,082; Philippines 230.
Tinned plates and sheets	do	397	407	487	United States 107.
Other coated plates and sheets	do	524	632	860	United States 305.
Hoop and strip	do	188	r209	254	United States 39; Thailand 32; Philippines 29.
Wire	do	377	r342	408	United States 199; Thailand 32.
Tubes, pipes and fittings:					
Seamless pipes and tubes, except cast iron	do	504	462	612	Mainland China 179; U.S.S.R. 65; United States 58.
Other	do	963	928	1,361	United States 544.
Other	do	157	57	56	Philippines 16; Pakistan 12.
Lead, metal, including alloys		9,997	7,978	4,821	Ryukyu 6,611.
Magnesium, metal, including alloys		122	74	76	Burma 45; South Korea 18.
Manganese, oxides		21,347	24,384	26,678	United Kingdom 2,346; mainland China 2,020.
Mercury	76-pound flasks	1,576	864	486	South Korea 470; North Korea 325.
Molybdenum, metal, including alloys		70	129	6	Taiwan 78; Australia 36.
Nickel, metal, including alloys		3,108	1,891	1,533	United States 1,305; mainland China 416.
Phosphorus, elemental (red)		546	570	527	United States 226; India 191.
Platinum-group metals, metal, including alloys, all forms.	thousand troy ounces	6	26	132	West Germany 11; United States 6.
Selenium, elemental		42	48	51	United Kingdom 23; United States 10.
Silver, metal, including alloys	thousand troy ounces	99	164	710	Taiwan 123; South Korea 33.
Titanium:					
Oxides (rutile and others)		37,745	27,745	35,409	United States 11,450; Sweden 1,960
Metal, including alloys, all forms		4,936	4,982	3,469	United States 4,858.
Tungsten, metal, including alloys, all forms		86	29	260	India 9; Brazil 6; South Korea 5.
Zinc, metal, including alloys, all forms		61,342	69,212	89,815	United States 39,121; Philippines 6,253.

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NONMETALS				
Abrasives, dust and powder of diamond ----- thousand carats ----	78	2,771	760	Netherlands 2,500.
Cement ----- thousand tons --	1,619	2,076	1,907	South Korea 499; Ryukyu 306; Philippines 238.
Clays and clay products (including all refractory brick), crude clays, n.e.s.	36,498	42,447	31,482	Philippines 21,529; Taiwan 11,751.
Diamond:				
Gem, not set or strung ----- thousand carats --	587	648	3	Netherlands 600.
Industrial ----- do ----	361	482	77	United States 385; United Kingdom 58.
Diatomite and other infusorial earths -----	436	657	773	Malaysia 220; South Korea 141.
Fertilizer materials: Manufactured:				
Nitrogenous ----- thousand tons --	2,687	3,380	3,490	Mainland China 1,729; India 363.
Other ----- do ----	186	196	222	Thailand 86; mainland China 21.
Gypsum and plasters -----	13,924	10,846	13,790	Singapore 6,719; Philippines 2,992.
Iodine -----	2,366	2,123	3,003	United States 716; West Germany 333; France 282; United Kingdom 224.
Lime -----	6,110	5,263	2,739	Singapore 1,888; Hong Kong 1,791; Ryukyu 1,392.
Magnesite -----	46,537	17,174	10,749	United States 11,581; Taiwan 1,175.
Precious and semiprecious stone, except diamond. thousand carats --	43,475	73,675	53,780	South Korea 41,735; United States 18,375.
Sodium and potassium compounds, n.e.s -----	76,718	84,075	127,874	Australia 46,819; U.S.S.R. 21,002.
Stone, sand and gravel, limestone (except dimension). thousand tons --	513	369	702	Australia 285; Hong Kong 81.
Sulfur:				
Elemental, all forms -----	5,492	1,745	12,755	South Korea 1,608.
Sulfuric acid -----	1,169	1,162	1,752	South Korea 406; Indonesia 312; Ryukyu 245.
Talc, steatite, soapstone and pyrophyllite -----	999	764	895	Philippines 298; Ryukyu 208.
Other nonmetals, n.e.s.: Oxides and hydroxides of magnesium, strontium, and barium.	23,836	18,915	22,376	Australia 15,111; Republic of South Africa 1,087.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black -----	9,519	12,984	15,693	Taiwan 2,825; Philippines 1,724; mainland China 1,500; Singapore 1,499.
Coal, all grades, including briquets -----	33,203	59,112	31,935	South Korea 32,521; Hong Kong 26,064.
Coke -----	58,448	46,454	62,908	South Korea 36,217.
Petroleum: Refinery products:				
Nonbunker:				
Gasoline ----- thousand 42-gallon barrels --	r 2,019	r 2,258	1,062	Ryukyu 1,603; Guam 289.
Naphtha ----- do ----	1,104	534	69	United States 226; South Korea 151.
Kerosine and jet fuel oil ----- do ----	2,314	2,380	1,515	Ryukyu 943; Hong Kong 704.
Fuel oil ----- do ----	1,861	2,308	893	South Korea 937; Hong Kong 715.
Lubricants ----- do ----	608	929	1,434	South Korea 423.
Asphalt ----- do ----	376	602	788	Indonesia 364; Ryukyu 73.
Other ----- do ----	267	255	186	Ryukyu 186.
Bunker: [2]				
Kerosine and jet fuel ----- do ----	3,829	5,308	NA	NA.
Distillate fuel oil ----- do ----	5,278	6,465	NA	NA.
Residual fuel oil ----- do ----	69,443	77,917	NA	NA.
Other ----- do ----	108	130	NA	NA.

r Revised. NA Not available.
[1] Excludes exports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces.
[2] From supplementary trade data.

Source: Japan Exports and Imports, Commodity by Country, 1966–68. Ministry of Finance.

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Table 3.—Japan: Imports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	1968	Principal sources, 1967
METALS				
Aluminum:				
Bauxite and concentrate—thousand tons	1,822	2,086	2,450	Indonesia 771; Australia 644; Malaysia 608.
Oxide and hydroxide	99,077	119,816	179,632	Australia 117,385.
Metal, including alloys:				
Scrap	19,094	20,845	23,939	United States 15,604.
Unwrought	77,001	165,177	169,142	Canada 86,916; United States 41,645; U.S.S.R. 26,780.
Antimony:				
Ore and concentrate	7,408	9,070	8,074	Bolivia 4,088; mainland China 2,625; Republic of South Africa 1,769.
Metal, including alloys, all forms	310	890	63	U.S.S.R. 429; Yugoslavia 230.
Arsenic, oxides and acids	2,787	2,044	3,412	France 1,599.
Chromium, chromite	421,873	595,693	635,860	Republic of South Africa 182,768; U.S.S.R. 147,669; Philippines 140,254.
Copper:				
Ore and concentrate	691,111	1,022,155	1,061,089	Philippines 407,769; Canada 333,853.
Matte	26,118	24,916	23,973	Chile 13,490.
Metal, including alloys:				
Scrap	66,883	77,114	58,007	United States 36,355; Canada 16,516.
Unwrought	149,665	269,995	291,530	Zambia 126,499; United States 30,265.
Iron and steel:				
Ore and concentrate—thousand tons	46,095	56,696	68,164	Australia 13,814; India 10,829; Chile 8,098; Peru 6,823.
Metal:				
Scrap—do	3,534	6,708	3,948	United States 5,168.
Pig iron including cast iron—do	2,862	6,450	4,456	U.S.S.R. 1,422; West Germany 924; Republic of South Africa 787.
Ferroalloys	3,095	70,622	62,738	Republic of South Africa 24,514; Norway 18,828.
Lead:				
Ore and concentrate	81,033	130,127	144,157	Canada 62,847; Australia 29,969; Peru 16,357.
Metal, including alloys, all forms	23,281	20,794	15,874	Territory of South-West Africa 7,312; Canada 3,137; Mexico 2,935.
Magnesium, metal, including alloys, all forms	1,047	841	405	Norway 391; U.S.S.R. 301.
Manganese, ore and concentrate [2]—thousand tons	1,140	1,507	1,732	India 474; Australia 311; Republic of South Africa 182.
Mercury—76-pound flasks	22,954	32,083	26,062	Mexico 11,713; Italy 7,255; Spain 4,449.
Molybdenum, ore and concentrate	7,336	8,787	9,539	Canada 3,272; United States 2,330; Netherlands 1,314.
Nickel:				
Ore and concentrate—thousand tons	1,270	1,661	2,712	New Caledonia 1,501.
Matte, speiss, and similar materials	5,048	9,619	12,553	Canada 6,369; New Caledonia 3,250.
Metal, including alloys, all forms	3,722	14,332	5,293	U.S.S.R. 5,096; United States 2,673; Canada 2,633.
Platinum-group metals: Metal, including alloys:				
Platinum—thousand troy ounces	185	234	214	U.S.S.R. 109; United Kingdom 67.
Palladium—do	380	r 354	600	U.S.S.R. 300; United Kingdom 43.
Silver, metal, including alloys—do	7,032	10,170	12,307	United States 4,038; Australia 2,858; Peru 1,733.
Tin:				
Ore and concentrate—long tons	1,687	594	1,102	Australia 277; Thailand 250.
Metal, including alloys, all forms—do	16,839	19,306	20,261	Malaysia 18,078.
Titanium:				
Ore and concentrate	324,952	273,609	363,924	Australia 94,385; Malaysia 89,717; Ceylon 56,454.
Oxides [3]	30,309	5,356	----------	Canada 5,356.
Tungsten, ore and concentrate	2,753	4,507	2,881	South Korea 1,432; Bolivia 635; mainland China 569.
Zinc:				
Ore and concentrate	446,112	614,079	856,668	Peru 298,691; Canada 120,708; Australia 100,804.
Metal, including alloys, all forms	7,650	18,111	8,846	Canada 12,139; Australia 2,518.

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NONMETALS				
Abrasives, natural, n.e.s	2,692	4,225	5,337	United States 2,509; mainland China 590; South Korea 505.
Asbestos	237,334	188,741	199,415	Canada 90,761; Republic of South Africa 67,896; U.S.S.R. 20,454.
Barite and witherite	39,171	33,793	6,120	Mainland China 26,695; India 5,535.
Boron materials:				
Crude natural borates	5,751	8,342	11,751	Turkey 5,944; United States 2,398.
Oxide and acid	8,157	8,003	11,114	United States 7,732.
Clay and clay products: Crude clay, n.e.s.:				
Kaolin	80,195	103,927	124,117	United States 65,948; South Korea 24,795.
Other	95,674	97,641	121,387	Republic of South Africa 47,034; United States 40,877.
Cryolite and chiolite	4,961	9,005	7,564	Denmark 9,005.
Diamond:				
Gem, not set or strung, thousand carats	281	512	324	Belgium 222; Israel 108.
Industrial, do	2,819	3,611	4,253	United States 1,291; United Kingdom 1,056; Belgium 736.
Fertilizer materials: Crude:				
Phosphatic, thousand tons	2,559	2,632	3,417	United States 1,886; Morocco 410.
Potassic, do	1,169	1,250	1,258	Canada 421; United States 386; U.S.S.R. 204.
Fluorspar	224,252	358,875	494,050	Mainland China 129,291; Thailand 112,795; Republic of South Africa 47,524.
Graphite, natural	52,742	55,197	62,933	South Korea 42,419.
Gypsum and plasters	49,083	43,961	57,087	Morocco 25,333; United Arab Republic 17,782.
Magnesite	24,137	34,997	24,710	North Korea 18,261; mainland China 8,025; U.S.S.R. 5,430.
Mica, all forms	4,517	7,623	18,278	India 5,674; South Korea 960.
Pyrite (gross weight)	265,564	78,546	---------	U.S.S.R. 60,800; Philippines 17,745.
Salt (excluding brines), thousand tons	3,832	4,432	5,023	Mexico 1,824; mainland China 983; United States 437.
Stone, sand and gravel: Quartz and quartzite	58,836	127,784	96,897	South Korea 106,996; United States 10,916.
Sulfur: Elemental, all forms	9,781	29	---------	Philippines 29.
Talc, steatite, soapstone, pyrophyllite	76,954	94,810	127,494	Mainland China 40,010; South Korea 32,596.
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	2,179	3,803	4,571	United States 3,689.
Coal and briquets:				
Anthracite, thousand tons	1,288	1,436	1,457	Republic of South Africa 329; North Vietnam 253; Canada 208.
Bituminous:				
Heavy coking coal, less than 8 percent ash, do	9,020	12,900	16,958	United States 9,896; Australia 1,718.
Heavy coking coal, more than 8 percent ash, do	6,038	6,601	6,817	Australia 3,628; U.S.S.R. 1,482.
Other coking coal, do	3,792	4,350	7,193	Australia 3,637; U.S.S.R. 426.
Lignite and lignite briquets, do	---------	21	15	Australia 21.
Coke and semicoke, do	---------	223	235	Australia 92; Czechoslovakia 73.
Petroleum:				
Crude and partly refined:				
Crude, thousand 42-gallon barrels	585,812	696,838	780,206	Iran 266,084; Kuwait 131,287; Saudi Arabia 110,764; Kuwait-Saudi Arabia Neutral Zone 84,655.
Partly refined, do	39,009	61,872	99,290	Kuwait-Saudi Arabia Neutral Zone 26,215; Saudi Arabia 22,675.
Refinery products:				
Naphtha, do	7,479	10,504	19,863	Kuwait 3,271; Saudi Arabia 2,912.
Kerosine and jet fuel, do	277	320	1,120	United States 201.
Distillate fuel oil, do	15,787	17,869	18,781	Netherlands Antilles 6,000; U.S.S.R. 4,271; Venezuela 2,981.
Residual fuel oil, do	61,747	71,742	90,925	Saudi Arabia 11,630; Singapore 9,969; Iran 8,428; United States 7,586.
Lubricants, do	5,980	5,267	4,467	United States 4,831.
Liquefied petroleum gas, do	9,489	14,024	20,219	Kuwait 7,122; Saudi Arabia 4,593.
Petroleum coke, do	6,039	7,150	9,652	United States 6,149.
Other, do	53	21	152	United Kingdom 16.

r Revised. [1] Excludes imports under Japanese-United States Mutual Defense Agreement or for account of U.S. military forces.
[2] Includes ferruginous manganese. [3] Includes titanium slag.

Source: Japan Exports and Imports, Commodity by Country 1966–68. Ministry of Finance.

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COMMODITY REVIEW

METALS

Aluminum.—As output increased 26 percent in 1968, Japan consolidated its position as the world's fourth largest producer of primary aluminum. Bauxite imports, upon which the country is heavily dependent for raw material, approached the 2.5-million-ton level. Principal sources of the $25.7 million worth of bauxite were Australia (37 percent), Indonesia (31 percent), and Malaysia (28 percent). Australia was also the origin of all the 176,000 tons of alumina imported for $10.5 million. Rising domestic demand, estimated at 700,000 tons of primary metal, not only moved Japan into third place in global consumption, but required the import of 169,000 tons of unwrought aluminum and alloys valued at $80.3 million. Canada supplied almost one-half of this amount. Exports of semimanufactures brought in $28.2 million.

The four producers of primary aluminum in 1968, with their percentage of total output, were Nippon Light Metal Co., Ltd. (33); Sumitomo Chemical Co., Ltd. (25); Showa Denko Co., Ltd. (25); and Mitsubishi Chemical Industries, Ltd. (17). Near yearend, primary metal producing facilities of these companies were as follows:

Company and facility	Annual capacity (thousand metric tons)
Nippon Light Metal:	
Kambara	111
Niigata	59
Sumitomo Chemical:	
Kikumoto	30
Nagoya	50
Niihama	54
Showa Denko:	
Chiba	74
Kitakata	43
Omachi	19
Mitsubishi Chemical:	
Naoetsu	104
Total	544

In addition to several expansions of existing facilities which were underway, at least one entirely new reduction plant—a 58,000-ton-per-year installation of Nippon Light Metal at Tomakomai on Hokkaido—was under construction. Scheduled for completion in 1970, the plant is later to be expanded to 130,000 tons annually. An associated alumina plant will be built nearby to eventually produce 320,000 tons per year. Other new primary aluminum plants planned or under consideration included a 37,000-ton-per-year facility by Mitsui Aluminum Industry Co., Ltd., at Omuta on Kyushu, a 56,000-ton reduction plant by Sumitomo Chemical at Toyama in north-central Honshu, a 105,000-ton installation by Mitsubishi Chemical at Sakaide on Shikoku, and a 80,000-ton plant by Showa Denko at Chiba in central Honshu. Much more tentatively, Kobe Steel Works, Ltd., already a significant aluminum roller, announced plans to build a reduction plant at Kakogawa in southern Honshu. Partially because of Government prodding to reduce potential pollution problems, most of these new reduction plants are to be sited away from already heavily industrialized areas and are to employ the prebake rather than the Soderberg system of processing.

Overseas, Sumitomo Chemical and Showa Denko each agreed to take a 25-percent interest in a new 107,000-ton-per-year reduction plant to be built at Bluff on South Island, New Zealand. At least one-half of the initial output of this plant, scheduled for start up in 1971, is to go to Japan.

To meet future bauxite requirements, expected to reach 7 to 8 million tons by 1975, producers were not only negotiating for increased tonnages from their traditional suppliers, but also were investigating potential sources in India and West Africa. In Australia, Commonwealth Aluminum Corporation Ltd. agreed to increase shipments from its Weipa deposit to 1 million tons annually for 10 years beginning in 1969, and Nabalco Pty. Ltd. was offering up to 1 million tons yearly from its Gove deposit for a 10- or 15-year period starting in 1971. In Indonesia, P.N. Aneka Tambang, the Government-owned bauxite mining concern, tentatively agreed to raise shipments from its Bintan Island deposit to 0.8 to 1.0 million tons annually for 10 years beginning in 1969.

Copper.—Domestic primary ingot production rose about 17 percent to a new high of 548,000 tons in 1968, solidifying the country's position as the fifth largest copper refiner in the world. The indigenous output of 120,000 tons of mine copper was only marginally higher, but still sufficient

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to put Japan among the 10 largest global producers. About 1,061,000 tons of concentrates, valued at approximately $271 million, were imported for smelting, with the Philippines (38 percent) and Canada (35 percent) the most important sources. Unwrought copper, including 127,000 tons of blister copper used to supplement the domestic blister output of 438,000 tons, and 157,000 tons of refined copper, was also imported at a cost of $345 million to satisfy strong indigenous demand. Zambia was the largest single supplier of both the blister (34 percent) and refined (62 percent) copper.

To obtain the estimated 700,000 tons of foreign copper needed by 1975 to meet projected growth, Japanese copper companies accelerated in 1968 their active search for overseas sources of ore. Financing in the form of loans or investment was offered in most cases where long-term supply agreements were obtained or discussed. Important contracts effectively concluded during the year included three 10-year agreements scheduled to begin in 1970: With Marcopper Mining Corp. in the Philippines for 40,000 tons annually of mine copper from its new mine on Marinduque Island, with Mount Lyell Mining and Railway Co. Ltd. in Australia for 20,000 tons per year of copper-in-concentrate from its new mine on Tasmania, and with Sheritt Gordon Mines Ltd. in Canada for 20,000 tons yearly of mine copper from its Fox deposit in Manitoba.

Under active consideration near yearend were a number of other generally larger projects, involving the purchase from Compañía Minera Andina S.A. in Chile of 50,000 tons of copper-in-concentrates per year from its Rio Blanco deposit for a 15-year period; from Lornex Mining Corp. in Canada of 50,000 tons of mine copper annually for 12 years from its British Columbia Highland Valley property; from Freeport Sulphur Co. of the United States of 40,000 tons of copper-in-concentrates yearly for 13 years from its West Irian property in Indonesia; and from Bougainville Copper Pty., Ltd., of 80,000 tons of mine copper per year for at least 10 years from its newly discovered Panguna deposit on Bougainville in the Solomon Islands. Work was also underway during the year in the Congo (Kinshasa) where joint Congolese-Japanese operations were developing various copper deposits to serve the Japanese market, and in Sabah in Malaysia where OMRDC was delineating the very large Mamut property for which it had won mining rights.

All of the major copper refining companies were expanding or planning to expand their domestic processing facilities. Mitsubishi Metal Mining Co. Ltd. (Mitsubishi Metal) had under construction a new 84,000-ton-per-year refinery adjacent to its 110,000-ton-per-year Naoshima smelter on Shikoku. Nippon Mining was about to increase the size of its present Saganoseki smelter-refinery on Kyushu from 84,000 to 120,000 tons annually, replacing the reverberatory furnace smelting process there by the Finnish flash smelting method. Sumitomo Metal was to build a new 108,000-ton-per-year smelter, also using the flash smelting method, next to its 90,000-ton-per-year Niihama refinery on Shikoku. Mitsui Mining and Smelting Co. Ltd. (Mitsui Smelting) was planning to construct, in conjunction with Nittetsu Mining Co. Ltd., a 60,000-ton-per-year refinery near its 45,000-ton-per-year smelter at Hibi in southern Honshu. The Onahama Smelting and Refining Co., Ltd., a joint venture of several copper refiners, was reportedly doubling the 60,000-ton-per-year capacity of its Onahama plant in northern Honshu.

Ferroalloys.—Under the guidance of the Ferroalloy Industry Coordination Council rationalization of this relatively weak industrial sector continued in 1968. Specifically, the Council was urging the replacement of smaller, older electric furnaces by larger, newer ones, with amalgamations of companies unable to modernize. Furnaces under the size of 4,000 kilovolt-amperes (kva) were to be superseded by units of the following recommended sizes: For silicomanganese, 15,000 kva; for ferrosilicon, ferromanganese and ferronickel, 10,000 kva; and for ferrochrome, 7,500 kva. The largest existing furnace is a 20,000 kva unit producing high-carbon ferrochrome at the Toyama plant of Nippon Steel Tube Co., Ltd., in north-central Honshu, followed by a 19,000-kva unit with a capacity of 60,000 tons per year of ferromanganese completed in 1968 by Kawasaki Steel Corp. at its Mizushima plant.

Under construction is a 30,000-kva furnace at a 100,000-ton-per-year ferromanganese plant being built by Nippon Electrical Industry Co., Ltd., at Anan on Shikoku, and a 25,000-kva furnace which will

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produce up to 40,000 tons of silicomanganese annually at Nippon Steel Tube's Niigata plant in northern Honshu. Also pending completion is an 18,000-kva furnace with a maximum annual capacity of 60,000 tons of low-carbon ferrochrome being erected at a 100,000-ton-per-year ferrochrome plant under construction by Nippon Light Metal at Tokuyama in southern Honshu. An estimated $29.4 million was invested in fiscal 1968 (April 1968–March 1969) in modernization of ferroalloy producing facilities.

Apparently unable to match the growing scale of their competitors, two medium-sized producers—Azuma Kako Co., Ltd. and Nippon Ferroalloy Co., Ltd.—agreed to merge on equal terms in early 1969 to form a single company having a 27- to 28-percent share of the entire ferroalloy market. With a total capacity of 200,000 tons per year in five plants, the concern will be the largest producer in its industrial sector. Similar mergers among other ferroalloy makers were anticipated. Because ferrosilicon was again in short supply in 1968, the entry into this specialized area of a 17th producer—Nippon Carbide Industries Co., Ltd.—was authorized by the Government.

Among the minor ferroalloys produced in 1968 were 2,202 tons of ferromolybdenum, 767 tons of ferrotungsten, and 1,578 tons of ferrovanadium. The basic 10 percent tariff on most imported ferroalloys and 15-percent levy on ferromanganese and ferronickel remained in force during the year.

Gold.—Demand for gold for nonmonetary purposes rose during fiscal 1968 to 1,222,000 troy ounces, forcing the Government to import 772,000 troy ounces and initiate a new program to increase domestic production. At present only about 40 percent of the gold refined in Japan comes from indigenous ores; the remainder is produced mainly as a byproduct of smelting imported ores. Of the eight largest precious metal mines producing the bulk (60 percent) of indigenous gold, allegedly only one—presumably the Kohnomai gold-silver mine of Sumitomo Metal on Hokkaido—was operating profitably.

Under the 5-Year Gold Mine Rationalization Program which went into effect during the year, about $13.3 million was to be spent by the Government in raising minable reserves from the present estimated 3.5 million troy ounces to 12.2 million, and increasing gold mine output from the estimated 175,000 troy ounces in fiscal 1968 to about 344,000 in fiscal 1972 (April 1972–March 1973). Specific targets were 12 general areas considered favorable for the discovery of reserves. In these areas some 41,000 meters of main shafts were to be driven at 20 existing or exhausted mines believed to have particular potential for further development. A gold mining promotion association, composed of miners and refiners of gold, was instituted to advise the Government on the program's administration.

Mitsubishi Metal, which had been reexamining its long-abandoned mine on Sado Island in the Sea of Japan, announced it would undertake a more comprehensive 2-year program of exploration. Near yearend a 500,000-ton reserve containing about 13 grams[4] per metric ton of gold and 820 grams per metric ton of silver was intersected. Shortly after, the company claimed discovery of a new deposit in northern Honshu ranking, allegedly, as the richest find since Kohnomai in 1915. Preliminary surveys reportedly revealed a vein about 1,300 feet long and 30 inches wide with an ore content of 3,000 grams of gold per metric ton. In addition, Chitose Mining Co., Ltd., a subsidiary of Mitsubishi Metal, declared it had uncovered at its active mine on Hokkaido three new veins grading 25 grams of gold and 90 grams of silver per metric ton. Shirogane Mining Co. Ltd., a subsidiary of Toho Zinc Co., Ltd. (Toho Zinc), announced discovery of a new 30-inch-wide vein with ore containing 11 grams of gold and 22 grams of silver per metric ton at its presently operating Onuchi mine in northern Honshu.

During the year Japanese smelters and refiners of imported copper and zinc ores were forced to start paying foreign mine producers the London free market gold price for the byproduct gold. Because the price of gold is controlled in Japan, this allegedly made processing unremunerative. Imminent conclusion near yearend of a major contract to import copper concentrates with unusually high gold values from New Caledonia raised hopes that as much as 200,000 troy ounces of gold could be derived annually from this source.

[4] 1 gram = 0.321507 troy ounce.

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Iron and Steel.—Japan's 1968 crude steel output, while still well below that of the United States and the U.S.S.R., was virtually equal to the combined output of the next two producing countries (West Germany and United Kingdom). Of the 66.9 million metric tons produced, 49.3 million tons (74 percent) was from basic oxygen furnaces, 12.2 million tons (18 percent) from electric furnaces, and only 5.4 million tons (8 percent) from open hearth furnaces. Nearly all of the 46.4 million tons of pig iron came from blast furnaces. Output of the 55.7 million tons of hot-rolled semimanufactures included 50.5 million tons of ordinary steel and 5.2 million tons of special steel.

Overall investment in the steel industry in fiscal 1968, as reported at yearend by industry sources, was approximately $1,423 million. About $180 million of this amount was in the form of loans from foreign financial institutions. Total employment averaged about 340,000 during the fiscal year, including about 262,000 production workers and 78,000 administrative, clerical, and technical personnel. Steel productivity rose almost 11 percent during fiscal 1968 and was lower than the national increase in productivity.

Consumption and Trade.—Despite sharply increased exports in 1968, the domestic market still consumed at least 75 percent of steel output. Construction activity, spurred by Government spending programs, accounted for the largest single portion—about 50 percent of national demand. Shipbuilding, the automobile industry, and the manufacture of industrial machinery absorbed roughly another 10 percent each.

After ranging between 9 and 10 million metric tons for 3 years, Japan's iron and steel exports rose in 1968 to a high of 13.2 million tons worth a record $1,812 million. This was 44 percent more by quantity and 33 percent more by value than in the previous year. However, in terms of crude steel equivalent, the proportion of exports to production (25.7 percent) was only slightly above the overall 25-percent average for 1964–68. The largest amount of exports, 7.3 million tons valued at $937 million, went to North America, principally the United States (6.9 million tons and $878 million). About 4.1 million tons worth $576 million was shipped to other Far Eastern countries, where the largest destination by far was mainland China (1.0 million tons and $142 million). Europe was the recipient of 600,000 tons valued at $105 million, followed by South America (500,000 tons and $78 million), Oceania (400,000 tons and $62 million), and Africa (300,000 tons and $54 million).[5]

Foreign sources continued to supply the bulk of the raw materials needed by the steel industry, accounting in 1968 for 93 percent of the iron ore and 76 percent of the coking coal received by iron and steel plants. The principal sources of the 68.2 million tons of iron ore imported at a cost of $834 million were Australia (13.8 million tons), India (12.6 million tons), Chile (8.7 million tons), and Peru (7.4 million tons). Coking coal imports, intended mainly for the steel industry, totaled 31.0 million tons valued at $492 million. The United States (14.2 million tons) and Australia (12.0 million tons) supplied most of this. Of the 3.9 million tons of imported steel scrap costing $158 million, the United States provided 74 percent. In addition, the industry required 4.4 million tons of foreign pig iron valued at $208 million. The Republic of South Africa and India each contributed about 17 percent of pig iron, followed by the U.S.S.R. (15 percent) and East Germany (12 percent).

Because of sharp reductions in the amounts of scrap and pig iron imported, and the jump in steel exports, the iron and steel industry contributed favorably to the national balance of payments in 1968. Government sources estimated that in fiscal 1968 this surplus amounted to $117 million. If exports of manufactured steel products such as machinery were included, the surplus would have been $836 million.

Reactions of foreign steel producers to the greatly increased amounts of Japanese steel entering world markets in 1968 presented major problems to the industry during the latter part of the year. The situation was particularly acute in the major U.S. market where anticipatory buying because of threatened strikes by steel and dock workers, increasing demand, and aggressive salesmanship, joined with the generally lower price of Japanese steel to raise Japanese shipments 59 percent in quantity and 47 percent in value over the previous year's levels. Proposed legis-

[5] U.S. Embassy, Tokyo, Japan. State Department Airgram 313, Apr. 10, 1969, pp. 1–5.

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lation to limit foreign steel imports into the United States was effectively deferred when, in conjunction with West European steel producers, the nine largest Japanese manufacturers announced intentions of limiting exports to the U.S. in 1969 to 5.0 to 5.2 million metric tons. Although this would represent a reduction of about one-third from the 1968 level, it would maintain Japan's 40 to 45 percent share of U.S. steel imports.

While some difficulties remained at year-end, such as the reluctance of smaller Japanese steel producers to abide by the agreement, and the necessity of developing alternate export outlets, it appeared that at least for the time being the U.S. market had been preserved at a lucrative level. Other countries which actually imposed restrictions in 1968 on steel imports, most of which were of Japanese origin, included Malaysia, Singapore, South Korea, Taiwan, and Thailand.

Structure.—Altogether at the end of 1968 there were nine integrated steelmakers, nine open hearth producers, about 180 electric furnace operators, and upwards of 200 shops for the melting and drawing of scrap into bars. Six integrated firms dominated the industry, accounting for over 90 percent of pig iron production and approximately 76 percent of crude steel output. These six, with approximate world rankings among private steel producers, were Yawata Iron and Steel Co., Ltd. (3d), Fuji Iron and Steel Co., Ltd. (4th), Nippon Steel Tube Co., Ltd. (8th), Sumitomo Metal Industries, Ltd. (9th), Kawasaki Steel Corp. (12th), and Kobe Steel works Ltd. (25th). Their crude steel output and share of the national production total in 1968 were as follows:

	Crude steel (thousand metric tons)	Share (percent)
Yawata Steel	12,370	18.4
Fuji Steel	11,300	16.9
Nippon Steel Tube	8,270	12.4
Sumitomo Steel	7,900	11.8
Kawasaki Steel	7,500	11.2
Kobe Steel	3,650	5.4
Other	15,900	23.9
Total national [1]	66,890	100.0

[1] Data may not add to total shown because of independent rounding.

At yearend 1968, 19 of the country's 22 existing or projected integrated plants belonged to the six major companies. These included the two largest operating plants—the 6.3-million-ton-per-year Wakayama plant of Sumitomo Steel and the 6.0-million-ton Chiba plant of Kawasaki Steel—as well as the new Kimitsu plant of Yawata Steel which began integrated operations in November. In April Nippon Steel Tube reorganized its three adjacent but separate Kawasaki, Mizue, and Tsurumi plants on Tokyo Bay into a single Keihin plant. Also in April, Kobe Steel erected the first production unit—a 600,000-ton-per-year heavy plate mill—at its new Kakogawa plant in southern Honshu.

New Equipment and Technology.—Two new blast furnaces, each claimed at the time of startup to be the largest in the free world, were blown in during 1968. These were the No. 2 furnace in February at the Fukuyama plant of Nippon Steel Tube, having an internal working capacity of 2,626 cubic meters and a rated capability of 6,000 metric tons per day, and the No. 1 furnace in November at Kimitsu with announced 2,705-cubic-meter and 6,000-ton capacities. By October, however, Fukuyama No. 2 had already produced 6,600 tons in a single day, allegedly a world record for a furnace of its internal size.

At yearend there were about 56 operable blast furnaces in Japan, almost all equipped for residual fuel oil injection and about 20 possessing high-pressure systems. Average pig iron ratio of all furnaces (daily iron output in metric tons per cubic meter) increased from 1:1.64 in 1967 to 1:1.72 in 1968. During March the 2,535-cubic-meter No. 4 furnace at Wakayama produced an average 5,169 tons daily of pig iron, and in May the 2,618-cubic-meter No. 2 furnace at the Sakai plant of Yawata Steel, using an iron charge of 42 percent pellets, 34 percent sized ore, and 24 percent sinter, poured out 5,310 tons of pig iron per day. Both furnaces had a pig iron ratio of slightly over 1:2.0 during these months, for which world records were also claimed. Greater use of sintered ore was singled out as possibly the most important factor in improved furnace productivity. The coke ratio of 504 kilograms per ton of pig iron produced, however, remained virtually the same in 1968 as in the previous 2 years.

Eight new basic oxygen furnaces were added in 1968, the largest of which were

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Nos. 1 and 2 at Kimitsu. With internal capacities of 350 cubic meters and output capacities of up to 250 metric tons per heat, these were also the largest yet installed in Japan. For the production of ordinary steel, most oxygen furnace productivity indexes remained the same as in 1967: The average hourly output was 170 tons and the average steelmaking time 37 minutes. With the addition of five new vacuum degassing units, however, the proportion of killed steel to total oxygen furnace output rose from 17 to 20 percent. Computer control advanced to the point where some oxygen furnaces were successfully reaching their end temperatures almost 80 percent of the time, and their carbon content targets 80 percent of the time.

Tokai Special Steel Co., Ltd., reportedly was producing alloy and carbon steels from its two 140-cubic-meter oxygen furnaces blown in in October, and Fuji Steel stainless steel from some of its oxygen furnaces. Nisshin Steel Works, Co., Ltd., which has an integrated stainless steel plant at Shunan based on electric furnaces, was planning to construct specialized oxygen furnaces for stainless steel manufacture.

Four new continuous casting machines were reported built in 1968, bringing the Japanese total up to at least 20 by yearend. The largest of these, a Concast S-curved type, eight-strand bloom casting machine with a 180-ton-per-charge and a 600,000-ton-per-year output capacity, was installed at Kawasaki Steel's Mizushima plant in August. This machine added to the growing number of casting machines supplementing conventional blooming and slabbing mills at large new integrated plants. One of these, a Mannesmann-Bohler S-curved one-strand slab casting machine at Keihin, allegedly established world records in October by pouring out 5,038 casts of 1,600- by 200-millimeter slabs without breakout and producing 38,000 tons during the month. The largest number of casting machines, however, were still being used to produce special steels. Overall production of steel by continuous casting methods was estimated at 2.5 to 3.0 million tons in 1968.

Automation and the use of computers increased further. At yearend there were approximately 90 computers installed for process control and probably an equal number for other uses. At least 15 blast furnaces, 15 basic oxygen furnaces, and 24 rolling mills were partially or entirely computer controlled. Among the many new production units featuring complete computer control was a 480,000-ton-per-year large-section mill installed in June at Mizushima. At Keihin all sheet rolling was placed under a single integrated computer system in March. Almost all operations and units at Kimitsu are being placed under complete computer control including, allegedly for the first time in the world, a heavy plate mill erected there in early 1968.

In September, the Japan Iron and Steel Institute established an Atomic Energy Division to study the potential of atomic energy in steelmaking. By far the most important of the research projects enumerated was a furnace in which coke would be largely replaced by nuclear-plant-generated, high-temperature gas blown into a charge. Growing industry needs for coking coal, expected to be in short supply during the 1970's throughout the world, was reportedly the principal immediate incentive for this line of development. An experimental atomic reactor was tentatively scheduled to be completed in 1972 for this purpose.

Lead.—Japan retained its sixth-place ranking in 1968 in world lead smelter output with a production of about 165,000 tons, a 10-percent increase over that of 1967. This rise was largely the result of the importing of a record 144,000 tons of lead concentrates valued at $26.5 million, since domestic output remained stagnant. The largest suppliers were Canada (34 percent), Peru (28 percent), and Australia (19 percent). The leading primary refined lead producers, with their yearend annual smelter capacities in metric tons, were as follows:

Toho Zinc Co., Ltd.	54,000
Mitsubishi Cominco Smelting Co., Ltd.	36,000
Mitsui Mining and Smelting Co., Ltd.	31,000
Nippon Mining Co., Ltd.	28,800
Sumitomo Metal Mining Co., Ltd.	20,400
Mitsubishi Metal Mining Co. Ltd.	19,800

A new refining company, the Hachinohe Refining Co., Ltd., was to bring on stream in early 1969 at Hachinohe in northern Honshu a lead-zinc plant with an annual capacity of 27,000 tons of refined lead. Hachinohe Refining is a joint venture of the following companies: Mitsui Smelting

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(50 percent); Dowa Mining Co., Ltd (Dowa Mining) (20 percent); Nippon Mining (10 percent); Mitsubishi Metal (10 percent); Toho Zinc (5 percent); and Nisso Smelting Co., Ltd. (5 percent).

Nickel.—In spite of the record 2.7 million tons of ore imported at a cost of $58 million, nickel was in short supply during the year. An estimated 9,500 tons of unwrought and semimanufactured metal was imported to help cover demand. As usual, most (89 percent) of the ore was from New Caledonia; because importers had overbooked fearing shortfalls due to adverse weather conditions and strikes, the amount received was actually greater than expected and caused temporary storage difficulties. Overall, however, the falling grade of the New Caledonia ore (which averaged only 2.7 percent), coupled with the failure of Japanese buyers to obtain long-term guarantees of increased shipments, forced nickel producers to accelerate development of alternate supply sources. Indonesia was apparently selected as having the most potential, although Japanese companies were also active in investigating nickel resources in Brazil and the Philippines.

On Sulawesi Island where Sulawesi Nickel Development Co. (Japan) was already mining 3-percent ore for shipment to Japan (235,000 tons in 1968), a tentative agreement was reached with the Indonesian Government to prospect for and exploit additional lower grade ore. A provisional contract was also signed by a number of Japanese companies to explore and develop low-grade nickel resources on a number of eastern Indonesian islands.

Nearly all of Japan's ferronickel producers, which include Nippon Mining, Nippon Metallurgical Co., Ltd., Pacific Nickel Co., Ltd., Shimura Chemical Industry Co., Ltd., and Sumitomo Metal, were planning expansions. Entirely new plants were being constructed by Pacific Nickel at Hachinohe (6,000 tons annually in terms of nickel content) and by Shimura Chemical at Sapporo on Hokkaido (4,500 tons annually).

Both nickel ingot producers—Shimura Chemical, which treats nickel matte from New Caledonia at its refinery at Amagasaki in southern Honshu, and Sumitomo Metal, which processes nickel sulfide ores from Canada and Australia at its Shisakajima smelter and Niihama refinery on Shikoku—were reported to have increased annual capacities to 12,000 tons. Tokyo Nickel Co., Ltd., a joint venture of Shimura Chemical (50 percent), International Nickel Co. of Canada (40 percent), and Mitsui Smelting (10 percent), completed in June a 5,000-ton-per-year nickel oxide plant at Matsuzaka in south-central Honshu. In October, Nippon Nickel Co., Ltd., finished a similar 10,000-ton-per-year facility at Tsuruga in north-central Honshu. The Matsuzaka installation presently treats matte supplied by International Nickel from Canada, and the Tsuruga plant matte from New Caledonia.

Tin.—Japan was the world's second largest consumer of tin in 1968. With only meager indigenous resources, the country relied heavily on imports to satisfy demand. Nearly 90 percent of the 20,000 metric tons of tin valued at $68 million imported during the year came from Malaysia, mostly from the Klang smelter of the Japanese-owned Oriental Tin Smelters, Ltd. Rasa Industries Co., Ltd., one of the four Japanese companies smelting tin domestically, also purchased about 1,100 tons of tin concentrate in 1968 from Australia. Because of sharp price fluctuations on the international market, however, it discontinued imports near yearend in favor of relying upon slimes from its Mitate mine in northern Honshu.

Uranium.—With one 166,000-kilowatt atomic powerplant already completed and five more with a combined capacity of 2.3 million kilowatts under construction, Japanese power companies accelerated their overseas efforts to secure uranium ore supplies. One agreement was made in early 1968 by a consortium of the nine major power companies and six mining concerns with the U.S.-based Kerr-McGee Corp. to explore jointly for uranium in Ontario, Canada. In late 1968 a provisional contract also was concluded with Canada's Denison Mines, Ltd. by the nine power companies to explore together for uranium on the latter's properties in Canada (British Columbia) and the United States (Colorado).

Total indigenous reserves of uranium ore were estimated near midyear at 10.3 million metric tons containing 5,323 tons of uranium oxide. Near yearend, further in-

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vestigation of a deposit in central Honshu indicated the existence of up to 3,000 more tons of minable uranium oxide.

Zinc.—In 1968 Japan was the world's seventh largest miner and third largest refiner of zinc. Domestic mine output increased only marginally, however, while concentrate imports rose 40 percent to a record 857,000 tons. Peru (45 percent), Canada (22 percent), and Australia (13 percent) were the principal sources of the $62.9 million worth of foreign concentrates. Refined metal production, including about 369,000 tons produced by electrolysis and 237,000 tons by distillation, increased 17 percent. Although expanding domestic demand was chiefly responsible for the rise in refined output, a high of 90,000 tons of unwrought and semimanufactured zinc valued at $25.7 million was exported. The United States, which took 44 percent of this total, was the principal destination.

In addition to the expansion of several zinc-producing "kuroku" ore mines, Nippon Mining was enlarging its conventional Toyoha lead-zinc mine on Hokkaido. With a reserve recently confirmed at 1 million tons of ore grading 7.3 percent zinc and 2.9 percent lead, crude ore output was being raised from 35,000 to 44,000 tons monthly. The largest producer of mine lead by far, however, was still the Kamioka lead-zinc mining complex of Mitsui Smelting in northern Honshu. In 1968 Kamioka produced from ore reserves recently evaluated at 41 million tons averaging 5.4 percent zinc and 0.5 percent lead approximately 120,000 tons of 58 percent zinc concentrate. An adjacent zinc refinery turnd out about 61,000 tons of refined metal.

Yearend refining capacity of the seven zinc refining companies was estimated at 672,000 tons annually, divided as follows:

	Tons
Mitsui Mining and Smelting Co., Ltd.	192,000
Toho Zinc Co., Ltd.	174,000
Nippon Mining Co., Ltd.	108,000
Mitsubishi Metal Mining Co., Ltd.	108,000
Sumiko Imperial Smelting Process Co., Ltd.	42,000
Nippon Soda Co., Ltd.	30,000
Dowa Mining Co., Ltd.	18,000

Scheduled for completion in early 1969 was Hachinohe Refining Co., Ltd.'s smelter-refinery at Hachinohe, with a 54,000-ton-per-year zinc capacity. Nippon Mining was also building for operation in early 1969 a 17,000-ton-per-year addition to its existing 43,000-ton-per-year Mikkaichi refinery in north-central Honshu. Dowa Mining reportedly began construction on a new 60,000-ton-per-year refinery at Akita in northern Honshu.

Other Metals.—Japan is a major world producer or consumer of a great many other metals. Because of its considerable nonferrous base metal smelting and refining capacity, the country ranks second internationally in the production of byproduct bismuth, third in cadmium and selenium, and about fourth or fifth in indium and tellurium. Its magnesium and titanium outputs are also among the world's largest.

Substantial amounts of foreign metals, usually in the form of ores or concentrates, are necessary to meet national demand for many of the metallic items of which Japan is an important consumer. During 1968 about $2.7 million of antimony concentrate was imported to supplement the minor national mine output. The principal suppliers of the 8,074 metric tons were Bolivia (73 percent) and mainland China (16 percent). To compensate for the country's small and decreasing low-grade chromite production, approximately 636,000 tons of high-grade chromite valued at $19.5 million was imported. The Republic of South Africa (28 percent), the U.S.S.R. (26 percent), the Philippines (20 percent), and India (18 percent) were the major sources. Australia (31 percent), Republic of South Africa (13 percent), and India (12 percent) were the largest suppliers of the approximately 856,000 tons of high-grade manganese ore, valued at $23.9 million, and India (59 percent) and the Republic of South Africa (30 percent) were the principal sources of the approximately 876,000 tons of ferruginous manganese ore, valued at $16.1 million, imported to complement the fairly substantial domestic output of low-grade manganese ore.

Slightly over 26,000 flasks of mercury were imported at a cost of $13.5 million in 1968 to bolster stagnating indigenous mine output and falling domestic refinery production. Italy (24 percent), Spain (20 percent), and Mexico (19 percent) were the most significant origins. To make up for the unimportant Japanese mine production of molybdenum, concentrate totaling 9,521 tons valued at $23.2 million was im-

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ported principally from the United States (41 percent) and Canada (36 percent). Titanium producers, wholly dependent on foreign ores, imported about 364,000 tons of concentrates with a value of $8.4 million. The bulk of their needs were met by about 121,000 tons of Malaysian ilmenite, about 97,000 tons of Australian ilmenite and rutile, and about 74,000 tons of Ceylonese ilmenite. In return, the export-oriented producers shipped abroad 3,469 tons of metal, the equivalent of 64 percent of their output. The principal recipient of this $7.7 million worth of metal was the United States (79 percent). Tungsten concentrate imports, while much reduced from those of the previous year, still supplied by far the greatest part of the country's requirements. The main origins of the 2,881 tons valued at $9.0 million were South Korea (40 percent), Thailand (17 percent), and Peru (14 percent).

NONMETALS

Cement.—Japan, which ranks third after the United States and the U.S.S.R. in world cement output, had a 1968 production 12 percent above the 1967 level. In exports it placed first in 1968, shipping 1.9 million tons abroad, mostly (63 percent) to other Far Eastern and South Asian countries.

There were 22 cement producers in 1968, operating 62 mills with an annual capacity of roughly 60 million tons. In addition, new cement plants having a combined annual capacity of 8 million tons were scheduled for completion by yearend 1969. Actual investments in the industry, spurred by forecasts of continuing expansion of construction activity in all areas of the economy in both the immediate and long-term future, totaled $15.8 million in fiscal 1968—an increase of 62 percent over that of fiscal 1967. Technologically, the present trend is towards the construction of large kilns using the dry process. Owing to recent improvements these kilns reduce fuel costs and blend raw materials more uniformly. In fiscal 1968, 11 large new kilns were installed, replacing 9 old kilns which were removed from service.

Fertilizer Materials.—Japan's chemical fertilizer industry chiefly consists of nitrogenous and phosphatic sectors. To meet ever increasing foreign demand for nitrogenous fertilizers, and compete with other world producers, the nitrogenous fertilizer industry is presently in the second stage of an expansion program, whereby increased production rates and cost reduction will be realized by the construction of larger and more efficient plants. The program calls for plants with an aggregate capacity of 9,150 tons daily to be completed by yearend 1972. Included among these will allegedly be the world's largest ammonia plant with a daily capacity of 1,550 tons, located at Chiba and scheduled to be completed by late 1970. The first of these plants, Mitsui-Toatsu Chemical Inc.'s 1,000-ton-per-day ammonia plant at Osaka, is scheduled for completion by the end of 1969.

As the world's largest exporter of nitrogenous fertilizers, Japan exported about 50 percent or 3.5 million tons (gross weight) of its 1968 output. Principal destinations including approximate tonnages, were as follows: Mainland China (1,760,000), India (386,000), South Korea (376,000), and Taiwan (256,000).

The phosphatic industry was scheduled to produce about 508,000 tons (P_2O_5 content) of phosphatic fertilizers in fertilizer year 1968 (July 1968 to June 1969), with future additions expected to raise annual production to about 734,000 tons by 1971. In 1968, Hinode Chemical Industry Co., Ltd. brought on stream two fused magnesium phosphate plants, with a combined total annual capacity of 200,000 tons. Current construction activities include Nippon Phosphoric Acid Co., Ltd.'s 68,000-ton-per-year phosphoric acid and 136,000-ton-per-year diammonium phosphate plants at Chiba and Toyo Soda Manufacturing Co., Ltd.'s smaller 33,000-ton-per-year phosphoric acid plant. Both projects are scheduled for completion by mid-1969. In 1968, an agreement was reached between three companies to proceed with the construction of a phosphatic fertilizer complex at Niigata in northern Honshu. Annual capacity is expected to be 73,000 tons of phosphoric acid and 110,000 tons of ammonium phosphates, as well as 110,000 tons of superphosphate and a total compound fertilizer capacity of 100,000 tons.

Virtually unendowed with any phosphatic or potassic fertilizer materials, Japan imported 3.4 million tons of phosphate rock, valued at $71.6 million, and 1.3 million tons of potash, valued at $45.4 million,

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in 1968. The United States supplied by far the largest part (74 percent) of the phosphatic material, and Canada (36 percent), United States (28 percent) and U.S.S.R. (16 percent) the bulk of the potash.

Salt.—Owing to Japan's expanding alkali industry which requires increasing quantities of salt, consumption increased 10 percent over 1967 levels to 6.0 million tons. More than four-fifths of Japan's 1968 salt requirements were met by imports, chiefly from Mexico (2,143,000 tons), mainland China (719,000 tons), India (515,000 tons), and Chile (430,000 tons).

To meet the growing demand for salt, forecast at over 9 million tons by 1979, major Japanese trading companies have taken a keen interest in developing salt resources in western Australia. Tentative agreements have been reached between the following Japanese and Australian interests, for shipments starting at the indicated dates: Mitsui and Co., Ltd., with Shark Bay Salt Pty., Ltd. (1968); C. Itoh and Co., Ltd., with Texada Mines Pty., Ltd. (1968); Toshoku Co., Ltd., with Leslie Salt Co. (1969); Sumitomo Trading Co., Ltd., with Norseman Gold Mines N.L. (1969); Toyo Menka Co., Ltd., with Exmouth Salt Co. (1970); and Marubeni-Iida Co., Ltd., and Nissho Co., Ltd., with Comalco Industries Pty., Ltd. (1971).

Sulfur and Pyrites.—The full impact of accelerating petroleum desulfurization was felt in 1968 when a number of new petroleum desulfurizing units, with a combined annual capacity of 175,000 tons of sulfur, went into operation during November and December. This gave the country a total yearend sulfur-from-oil recovery capacity of 415,000 metric tons annually. Nearly all of the companies mining elemental sulfur operated at a loss as the price of sulfur dropped to somewhat less than $56 per metric ton, reportedly the break-even point for their operations. The largest of these companies—Matsuo Mining Co., Ltd., accounting for 35 to 40 percent of national output from its Matsuo mine in northern Honshu—declared bankruptcy in December.

The plight of the elemental sulfur miners, the unlikelihood of consumption rising much above its present 300,000-ton-per-year level, and the prospect of a 370,000-ton annual surplus by 1972, forced the Government into taking remedial action. MITI requested the Ministry of Finance to approve a $278 million loan from the Japan Development Bank for the construction of a $417 million sulfur export center. The center, which apparently will be operated jointly by the Government, sulfur miners, sulfur-producing oil firms, and trading companies, will concentrate on developing Far Eastern, South Asian, and Australian markets. A trade mission was despatched to India in late 1968 to investigate its market potential.

The country remained the world's largest producer of sulfide ores, again producing about 2 million tons of contained sulfur in largely pyritic ores. Sulfuric acid producers consumed by far the largest portion of the "pyritic" sulfur, but also relied on sulfur recovered from smelter flues for about 30 percent of their supply. Dowa Mining, the largest of the Japanese pyrite producers with three major mines (Hanaoka, Kosaka, and Yanahara) was building a 400,000-ton-per-year sulfuric acid plant at Okayama in southern Honshu. This was a part of a MITI program to modernize the sulfuric acid industry, some 80 percent of whose facilities are considered obsolete. Because sulfur obtained from pyrites and smelter gas is currently priced at $36 per metric ton, competition from recovered sulfur as a source for sulfuric acid is not yet acute. During the year Dowa Mining and Nippon Mining, another important pyrite producer, became the first Japanese members of the International Sulphur Institute.

Other Nonmetals.—Japan's 1968 production of large volume nonmetallic construction materials expanded significantly with the growth in construction activity. Limestone, the most important of these, increased 12 percent, followed in order of importance by lime, silica sand, silica stone, and dolomite. Gypsum and asbestos production declined 4 percent and 12 percent, respectively. The decrease in asbestos was unimportant, however, as imports, totaling about 199,000 metric tons with a value of $30.5 million, were nine times domestic output. The principal origins were Canada (53 percent) and Republic of South Africa (33 percent).

The flourishing ceramics industry stimulated increases in output of such materials as feldspar, fire clay, kaolin, pyrophyllite

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(in which Japan leads the world) and talc. Nevertheless, substantial imports of several of these commodities were needed to meet demand. The United States (56 percent) and South Korea (32 percent) supplied the largest part of the approximately 124,000 tons of foreign kaolin valued at $6.3 million. Of the approximately 127,000 tons of talc and soapstone imported at the cost of $3.9 million, mainland China (45 percent) and South Korea (30 percent) provided the largest part.

Rising consumption by basic oxygen furnaces brought fluorspar imports, upon which the steel industry is almost entirely dependent, to about 494,000 tons valued at $17.2 million. Thailand (39 percent), mainland China (22 percent) and Republic of South Africa (15 percent) were the principal suppliers. Production of elemental iodine, in which Japan leads the world and over 40 percent of which goes to the United States (1,450 tons in 1968), increased 23 percent. Total exports amounted to 3,003 tons valued at $6.8 million. Barite output rose sharply (45 percent) in the face of expanding demand for it in offshore oil drilling operations, but was not expected to suffice. South Korea continued to supply the largest portion (68 percent) of the approximately 63,000 tons of graphite worth $2.2 million imported to supplement the minor and dwindling internal production.

MINERAL FUELS

Coal.—The financial condition of the coal industry deteriorated further in 1968. By the end of September, total deficits of the 16 major companies accounting for 72 percent of production had reached about $500 million, with an additional approximately $550 million outstanding in loans. Taiheiyo Coal Mining Co., Ltd., the only one of the major firms paying dividends, ceased to do so during the year.

In December the Coal Mining Industry Rationalization Corp., an advisory body to MITI, recommended a program (later adopted almost intact) of accelerated Government subsidization of the industry. During the 5-year period April 1969–March 1974 an estimated $1.2 billion is to be spent in a variety of measures designed to assume much of the deficits accumulated by existing companies, expand the amount of Government-backed, interest-free loans available to the industry, increase direct price support of coal to an average $1.12 per metric ton, further underwrite the purchase of domestic coal by major consumers, facilitate the closing down of inefficient mines, and rehabilitate areas where pit closures would seriously affect local economies. Altogether, Government support of coal production is expected to amount to somewhat over $2 per metric ton. As before, most of the supporting funds for the new measures were to come from a levy on imports of crude and residual fuel oils. In fiscal 1969 alone (April 1969–March 1970), approximately $246 million—almost 50 percent more than in the previous fiscal year—was to be appropriated, of which about 85 percent was to originate in the petroleum levy.

While nationalization of the coal industry apparently has been rejected, some sort of drastic reorganization is expected. Moreover, the overall production target is to be reduced from 50 to 35 million tons annually.

The financial dilemma of the coal industry was accompanied by a 2-percent decrease in output. Bituminous steam coal fell roughly 3 percent to 32,281,000 tons, anthracite 2 percent to 1,489,000 tons, and natural coke 4 percent to 418,000 tons. Bituminous coking coal production remained virtually unchanged at 12,380,000 tons. Hokkaido produced 46 percent of all coal, followed closely by Kyushu with 43 percent, and distantly by Honshu with 11 percent. By far the most important field was Ishikari on Hokkaido, which accounted for 35 percent of total output, 27 percent of bituminous steam coal, and 59 percent of bituminous coking coal. Operating mines decreased from 165 at the beginning of the year to 149 at the end, and the number of permanent workers from about 89,000 to 79,000. Overall productivity rose encouragingly, however, from 1,590 kilograms per man-shift in 1967 to 1,787 kilograms per man-shift in 1968.

Spurred on by rising steel industry demand for coke, coal imports (mostly bituminous coking coals) increased 27 percent to 32,440,000 tons valued at $519 million. Principal suppliers were the United States (44 percent) and Australia (37 percent). The most important contract concluded with foreign coal producers in 1968, however, was with a Canadian subsidiary of the Kaiser Steel Corp. of the United States for the export from its properties in western Canada of at least 3 million and possibly 4 million tons per year of coal. Beginning

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in 1970, the contract is to extend 15 years. In addition, McIntyre Porcupine Mines Ltd. agreed to ship 2 million tons of coal annually for 15 years beginning in 1970 from its Alberta properties. The most significant of several foreign offers being negotiated at yearend was with the U.S.-based Utah Development Ltd. of Australia for the shipment of at least 4 million and possibly even 7 million tons of Queensland coal annually for 13 years starting in 1971.

Total coal consumption in 1968 was 82.2 million tons, including 50.1 million tons indigenously produced and 32.1 million tons imported. The steel industry (48 percent) and public utility powerplants (31 percent) accounted for the greater part of use; the former consumed almost 90 percent of foreign coal and the latter slightly over one-half of the domestic coal.

Petroleum.—*Consumption.*—Demand continued to spiral in 1968, with domestic refined product use up roughly 18 percent to 919 million barrels. This kept Japan in third place in world consumption, well ahead of West Germany. Breakdown of product use, was as follows:

Product	Consumption (million barrels)	Increase over 1967 (percent)
Gasoline	101	14.2
Naphtha	100	26.0
Kerosine and jet fuel	65	16.4
Distillate fuel oil	105	16.7
Residual fuel oil	445	17.1
Liquefied petroleum gas	75	29.8
Other	28	18.7
Total	919	17.7

The most important of the 20 marketing companies, were, with their percentage of the domestic market: Nippon Oil Co., Ltd. (17.9), Idemetsu Kosan Co., Ltd. (15.8), and the Government-backed Kyodo Oil Co., Ltd. (10.2).

Refining.—The overwhelming proportion of petroleum needs were met by imports. Intake of crude and partly refined oil rose 17 percent to 879 million barrels, valued at $1,685 million, and product imports 30 percent to 165 million barrels valued at $415 million. Almost 91 percent of crude supply came from the Middle East, as follows: Iran (37.2 percent); Saudi Arabia (18.9 percent); Kuwait (13.5 percent); Kuwait-Saudi Arabia Neutral Zone (11.8 percent); and others (9.4 percent). Indonesia, providing 7.8 percent of crude oil imports, was the principal source outside the Middle East. Japanese-owned oil companies—specifically, the Arabian Oil Company which operates in the Kuwait-Saudi Arabia Neutral Zone and North Sumatra Oil Development Cooperation Co. which functions in Indonesia—produced somewhat over 12 percent of the imported crude oil. The average c.i.f. price per barrel of crude was $1.91, compared with $1.92 in 1967. A small (3.2 percent) but growing amount of foreign crude oil was imported for nonrefining purposes, principally for direct burning by powerplants.

Japanese crude refining capacity was estimated at 2,751,000 barrels per stream day at yearend, an increase of almost 18 percent over that at yearend 1967. This apparently moved Japan ahead of West Germany into fourth place internationally. Principal refining increases during the year, including both additions to existing plants and new refineries brought on stream, are shown in the accompanying tabulation.

Nippon Oil Refining, whose Negishi refinery is now the largest in the country, also had the largest refining capacity of any company (342,000 barrels per day), followed by Idemetsu Kosan (320,000 barrels per day) and Toa Nenryo Mining (291,000 barrels per day). All of the important new additions and refineries were on Honshu,

Company	Refinery	Capacity (thousand barrels daily)	
		Added	Total
ADDITIONS			
Nippon Oil Refining Co., Ltd	Negishi	110	220
Toa Nenryo Mining Co., Ltd	Wakayama	60	187
Toa Oil Co., Ltd	Kawasaki	50	100
NEW			
Fuji Oil Co., Ltd	Chiba	XX	70
Kansai Oil Co., Ltd	Sakai	XX	60
Kyokuto Oil Mining Co., Ltd	Chiba	XX	60

XX Not applicable.

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which now holds 34 of the 39 refineries and 94 percent of the refining capacity.

Production of refinery products was up roughly 16 percent in 1968 to an estimated 881 million barrels. Refiners experienced increasing difficulties, however, in adjusting output patterns to meet rising demand for residual fuel oil by the electric power industry and naphtha by the petrochemical industry. A high of 90.9 million barrels of residual fuel oil and 19.9 million barrels of naphtha, each equivalent to about 20 percent of internal use of these products, had to be imported. Accelerating naphtha demand, forecast to virtually double in 5 years, is expected to aggravate the problem.

The oil industry was faced during the year with increasing pressure to reduce the sulfur content of petroleum. By increasing the amounts of lower sulfur crude oils imported from the Middle East at the expense of higher sulfur crudes from the same area, the sulfur content of all imported crude was reduced from 1.834 percent in 1967 to 1.693 percent in 1968. In addition, numerous special desulfurizing units were being erected by refiners, involving in most cases the use of U.S. technology. By yearend about 88,000 barrels per stream day of desulfurizing capacity was already in operation, with an additional 280,000 barrels per stream day under construction or planned. An immediate objective was to lower the sulfur content of about one-third of all Japanese-produced residual fuel oil —usually a high-sulfur-content product—to at least 2 percent by yearend 1969. Electric power companies, however, responding to strong local anti-air-pollution pressures, were requesting permission to import larger amounts of low-sulfur crude oils for direct burning in order to more quickly reduce sulfur contents to within the 1.0- to 1.6-percent range.

Terminals.—The development of large crude oil unloading facilities, capable of handling tankers of ever-increasing sizes, received much attention during 1968. Near midyear four refining companies having plants near Chiba on Tokyo Bay with a combined refining capacity of nearly 400,000 barrels per stream day opened a dolphin-type unloading station to receive 200,000-deadweight-ton tankers. Operating under the name of Keiyo Sea Berth Co., Ltd. this facility, without storage capacity, anchors vessels while they discharge loads through lines ranging from about 2 to 6 miles long to the individual refineries. At another location in Tokyo Bay four other refining companies were constructing under the name of Ogishima Oil Storage Co., Ltd. a more sophisticated unloading terminal on an artificial island. During its first stage, scheduled for completion in early 1969, this facility will receive crude oil from 200,000-deadweight-ton vessels through a line somewhat more than 2 miles long, and relay it through a number of smaller lines 2 to 3 miles to the refineries. At a later stage, equipment, which will initially include 1.6 million barrels of storage capacity, is to be enlarged to handle 300,000-deadweight-ton tankers.

In addition to these facilities, the construction of up to 14 even larger terminals were under consideration near yearend. These Central Terminal Stations would all be capable of receiving tankers of at least 300,000, and possibly even 500,000, deadweight tons. One, Nippon Oil Staging Terminal Co., Ltd., was actually under construction in Kagoshima Bay in southern Kyushu with completion of initial equipment, including 7.6 million barrels of storage, set for late 1969. Oil from this terminal, to be jointly owned and operated by three refining companies, will be transhipped by smaller vessels to the appropriate refineries.

Exploration.—Offshore exploration in the Sea of Japan during 1968 resulted in several applications for mining rights. Nippon Oil set up a subsidiary which filed for a 11,200-square-mile area off Nagasaki Prefecture in southwestern Kyushu; California Texas Oil Corp. was reportedly to join Nippon Oil later. Teikoku Oil Co., Ltd. applied for 2,500 square miles in the same general area. In addition, KODAN claimed some 37,000 square miles off northern Hokkaido.

To further promote overseas crude oil development by Japanese interests, KODAN extended $15.2 million in assistance during fiscal 1968. This amount, far exceeding the $4.7 million of the previous year, was in the form of both direct investments (75 percent) and loans (25 percent). The seven recipients of these funds were engaged in exploration in such diverse areas as Abu Dhabi, Canada, Indonesia, Malaysia, New Guinea, and the United States (Alaska).

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The Mineral Industry of Kenya, Tanzania, and Uganda

By Eugene R. Slatick [1]

Mineral production in these three countries in 1968 totaled about $70.6 million,[2] down from $81.5 million in 1967. The value of production increased in Kenya but declined in Tanzania and Uganda.

These countries comprised the East African Common Market (EACM) until December 1967 when a new organization, the East African Economic Community, was formed because of dissatisfactions with the original arrangement. In 1967 mineral exports from these countries to countries outside the EACM reached a value of $95.6 million, compared with $76.2 million in 1966. Mineral imports also rose in value, from $86.1 million in 1966 to $102.2 million in 1967. Only Tanzania and Uganda had favorable balances in mineral trade. Because of the deficit in Kenya's mineral trade, the total mineral trade balance of the three countries had a deficit of $6.6 million. That was an improvement, however, compared with the 1966 deficit of $9.8 million.

The value of total exports and mineral exports within the EACM, by countries in million dollars for 1967, is summarized as follows:

EACM exporting country	Total EACM exports	Total EACM mineral exports	Mineral exports (receiving country)		
			Kenya	Tanzania	Uganda
Kenya	78.3	14.5	--------	6.3	8.2
Tanzania	11.3	.6	0.5	--------	.06
Uganda	35.3	3.0	2.1	.9	--------

East African Railways and Harbors, which is part of the East African Common Services Authority, continued to provide essential services to the mineral industry.[3] In 1967 the railways hauled about 4.5 million tons of materials, including about 1.1 million tons of mineral commodities (in 1966, about 4.5 million tons, including about 1.7 million tons of mineral commodities). The import and export tonnages handled at East African ports during 1967 totaled 7.4 million deadweight tons (dwt), including 3.5 million dwt of bulk oil (in 1966, 6.8 million dwt, including 3.3 million dwt of bulk oil). Oil bunkering in 1967 was as follows: Mombasa, Kenya, 468,471 dwt (133,026 dwt in 1966), and Dar es Salaam, Tanzania, 2,789 dwt (3,806 dwt in 1966).

KENYA

Kenya's mineral industry remained relatively small in 1968. In 1967, mining and quarrying contributed about $4.68 million, or 0.4 percent, to the country's Gross Domestic Product (GDP), which was provisionally valued at $1,124 million at cur-

[1] Foreign mineral specialist (petroleum), Division of International Activities.

[2] Where necessary, values have been converted at the following rates: Kenya shilling 1, Tanzania shilling 1, and Uganda shilling 1 = US$0.14.

[3] East African Railways and Harbors. Annual Report. 1967. 1968, pp. 64–65.

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rent prices;[4] the contribution in 1968 probably was of the same magnitude. During the 1963–67 period, the GDP grew at the cumulative annual rate of 7.2 percent; by contrast, the value of mining and quarrying grew at the rate of only 0.3 percent.

Statistics for the mining industry for 1966, the most recent year available, are summarized as follows:[5] Labor force, 1,138; expenditures, $4,010,476 (prospecting, $2,589,264; mine development, $674,668; mining and milling, $746,544); and Government revenue from the industry for fiscal year July 1965–June 1966, $26,202, mostly from mining fees and royalties. Of the 304 mining claims existing at the beginning of 1967, 198, or 65 percent, were for nonprecious minerals; 182 of the total claims were in the Rift Valley Province.

PRODUCTION AND TRADE

In 1968 the value of mineral production was about $20 million, compared with about $16 million in 1967. Cement and soda ash continued to be the major mineral commodities produced, being valued at $10.4 million and $3.4 million, respectively. The Mombasa oil refinery processed imported crude oil valued at an estimated $20 million to produce products valued at an estimated $39.5 million. Coral limestone was also produced in 1968; it was last reported in 1962.

In 1967 petroleum was the major mineral commodity in both exports and imports. Exports of refinery products were valued at $18.9 million, compared with $16.7 million in 1966. Other significant mineral exports were soda ash, $2.9 million, and cement, $2.8 million. Imports of crude oil in 1967 were valued at $26.5 million, compared with $25.5 million in 1966. Imports of iron and steel semimanufactures were valued at $15.2 million compared with $13.9 million in 1966. The value of mineral trade and total trade for recent years was as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	22.7	132.1
1966	25.1	162.6
1967	26.0	149.9
Imports:		
1965	50.4	249.8
1966	55.1	314.7
1967	55.3	298.5

COMMODITY REVIEW

Metals.—*Columbium-Tantalum.*—In October the Government granted Péchiney-St. Gobain, a French company, a 2-year permit to prospect and mine columbium in a 4-square-kilometer area at Mrima Hill, about 64 kilometers southwest of Mombasa. The Mrima Hill pyrochlore-bearing carbonatite, reportedly one of the world's largest columbium deposits, has been known since the mid-1950's. It has not been mined, however, because the fine size of the columbium particles present (80 to 90 percent are smaller than 53 microns, 50 percent are smaller than 12 microns) makes the ore difficult to beneficiate economically.[6] Péchiney-St. Gobain did not say how it intends to treat the ore. Total reserves of columbium are at least 38 million metric tons averaging 0.67 percent Cb_2O_5; high-grade areas contain about 1.1 million tons averaging 1.75 percent Cb_2O_5.[7] Reserves of rare-earth oxides are estimated at 6.3 million tons averaging over 5 percent, and 32 million tons averaging 1.1 percent.

Uranium.—Late in the year, exploration for uranium-bearing minerals was begun by Società Minerali Radioattivi Energia Nucleare (SOMIREN), a subsidiary of Italy's Ente Nazionale Idrocarburi (ENI). SOMIREN was granted a 54,000-square-kilometer concession in September in northeastern Kenya, near the border with the Somali Republic.

Nonmetals.—*Cement.*—Additions to the cement plant of Bamburi Portland Cement Co., at Mombasa, increased the annual capacity from 400,000 tons to 500,000 tons. The expansion program, costing about $2.8 million, is expected to be completed by mid-1969, when the capacity will reach 700,000 tons per year.

The rise in cement production in 1968 reflects the continuation of the country's building boom. The trend is expected to continue through 1969. The local raw materials used to produce cement in 1968 included: Limestone, 103,000 tons; Kunkur

[4] Republic of Kenya, Statistics Division, Ministry of Economic Planning and Development. Statistical Abstract. 1968, pp. 31–32.
[5] Republic of Kenya, Mines and Geological Department. Annual Report, 1966. 1968, pp. 12–14.
[6] Binge, F. W. and Joubert, P. (revised by J. E. Mason). The Mrima Hill Niobium Deposit, Coast Province, Kenya. Mines and Geological Dept., Ministry of Natural Resources Inf. Circ. 2, 1966, pp. 41–42.
[7] Page 36 of work cited in footnote 6.

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Table 1.—Kenya: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Beryllium, beryl concentrate, gross weight	1	1	-------	17	7
Copper, mine output, metal content	2,077	1,969	798	11	37
Gold, mine output, metal content—troy ounces	12,480	11,420	11,988	33,366	31,974
Silver, mine output, metal content—do	47,702	21,247	19,008	3,038	2,769
NONMETALS					
Abrasives, natural, n.e.s.: Corundum	NA	-------	NA	25	43
Asbestos	185	123	66	51	-------
Barite	-------	86	98	212	356
Carbon dioxide, natural	746	762	817	817	819
Cement, hydraulic—thousand tons	422	484	484	479	545
Clays, kaolin	1,288	1,714	893	1,456	1,332
Diatomite	3,055	2,218	1,772	1,886	2,055
Feldspar	-------	-------	164	402	535
Gem stones, precious and semiprecious, except diamond: [2]					
Garnet [3]—kilograms	NA	NA	134	158	210
Sapphire—carats	2,204	4,212	3,525	8,308	28,055
Gypsum and anhydrite, crude	27,994	34,474	33,743	40,446	41,089
Magnesite, crude	170	67	678	422	68
Meerschaum—kilograms	204	2,000	694	143	82
Pumice	1,438	1,039	793	122	-------
Salt:					
Rock—thousand tons	27	31	31	25	33
Marine—do			23	24	28
Soda, raw crushed (Trona)	2,220	2,548	2,463	3,224	2,283
Soda ash	81,670	83,194	112,400	104,755	117,250
Stone, sand, and gravel n.e.s.: Crushed and broken: Limestone, other than for cement	12,095	NA	16,734	19,041	18,275
Vermiculite	34	22	76	251	279
Wollastonite	-------	-------	-------	12	1,382
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline, motor—thousand 42-gallon barrels	1,827	r 2,247	r 2,178	2,261	2,201
Kerosine—do	882	r 1,421	r 1,355	1,646	1,591
Distillate fuel oil—do	1,671	r 2,141	r 2,289	2,783	2,954
Residual fuel oil—do	6,012	r 6,645	r 6,230	6,580	6,387
Liquefied petroleum gas—do	57	r 80	r 95	71	94
Asphalt and bitumen—do	64	r 172	r 226	306	252
Total—do	10,513	r 12,706	r 12,373	13,647	13,479

r Revised. NA Not available.

[1] In addition to the commodities listed, lime, mica (all grades), and quartz and quartzite are produced, but the quantities are small or not avilable; in 1968, 628,046 tons of coral was produced.

[2] Small amounts of the following were also reported in 1968: Aquamarine, amethyst, chrysoprase, ruby, and tourmaline.

[3] Quality (gem or industrial) not specified.

Limestone (cement rock), 65,752 tons; shale, 89,534 tons; and volcanic ash, 3,919 tons.

Fertilizer Materials.—Construction of the 109,000-ton-per-year fertilizer plant planned for Mombasa was postponed indefinitely in 1968. It was considered uneconomical because of the relatively small domestic requirements and the need to import some raw materials. Triangle Fertilizer, Ltd., a consortium including the Government, was to have been the operator.

Deposits of bat guano about ½ kilometer long and as much as 4 meters thick were found in caves in the Chyulu Hills, about 160 kilometers southeast of Nairobi.[8] A dry analysis of the guano is as follows, in percent: Nitrogen, 13.2; phosphate (P_2O_5), 11.0; potassium oxide (K_2O), 3.5; calcium, magnesium, and sulfur, 6.5; organic matter, 65.8.

Mineral Fuels.—*Petroleum.*—Throughput at the Mombasa refinery in 1968 totaled about 14.1 million barrels, down slightly from 14.5 million barrels in 1967. During the year, British Petroleum-Shell Petroleum Development of Kenya extended their exploration to offshore areas north of Lamu, near Somali Republic. Late in the year the Government invited French interests to explore for oil in Kenya.

[8] The Journal of World Phosphorus and Potassium. No. 34, March/April 1968, p. 49.

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Table 2.—Kenya: Exports of mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys: Semimanufactures	------	6
Beryllium, beryl ore and concentrate	------	16
Copper, metal, including alloys: Unwrought and semimanufactures	1,589	------
Gold, metal, unworked or partly worked----troy ounces	12,019	26,942
Iron and steel, metal:		
Scrap	5,718	5,578
Semimanufactures	76	198
Silver, metal, including alloys troy ounces	16,924	------
Other, nonferrous metals, scrap	2,368	2,247
NONMETALS		
Cement	169,534	221,189
Diatomite and other infusorial earths	775	734
Lime	4	1
Salt and brines	165	774
Sodium compounds, soda ash, sodium carbonate	106,751	98,330
Stone, sand and gravel	6	189
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	241	249
Kerosine----do	789	729
Distillate fuel oil----do	448	865
Residual fuel oil----do	3,467	4,615
Liquefied petroleum gas. do	47	1
Asphalt----do	99	11

[1] Excludes reexports.

Table 3.—Kenya: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys:		
Unwrought	------	3
Semimanufactures	666	678
Copper, metal, including alloys:		
Unwrought	62	48
Semimanufactures	323	221
Gold bullion----troy ounces	7,084	6,748
Iron and steel:		
Ore and concentrate	6,748	5,588
Metal:		
Scrap	------	16
Pig iron, ferroalloys, and similar materials	1,528	1,362
Steel, primary forms:		
Ingots and other	27	151
Semimanufactures	82,735	644,117
Lead, all forms	210	312
Nickel, metal, including alloys, unwrought	2	4
Tin, all forms----long tons	77	28
Zinc, all forms	1,185	1,046
Other, nonferrous metal scrap	46	67
NONMETALS		
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones	29	------
Asbestos	------	55
Cement	611	884
Clays and clay products, refractory products (including nonclay bricks)	------	1,146
Feldspar, fluorspar, cryolite and chiolite	3,357	4,396
Fertilizer materials, manufactured:		
Nitrogenous	31,182	29,266
Phosphatic	21,000	15,646
Potassic	841	771
Other, including mixed	18,175	19,073
Graphite, natural	22	18
Lime	48	46
Mica, crude, including splittings and waste	15	22
Salt and brines	5,488	5,046
Stone, sand and gravel	775	613
Sulfur, elemental, all forms	1,482	258
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	47,486	48,898
Coke and semicoke	1,888	1,242
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	18,688	14,228
Refinery products:		
Gasoline----do	231	129
Kerosine----do	681	252
Distillate fuel oil--do	118	422
Residual fuel oil--do	2	248
Lubricants----do	119	154
Other----do	155	82

TANZANIA

In 1968, Tanzania's mineral industry was once again dominated by diamond, the industry's chief contributor to foreign exchange earnings and a major contributor to the economy. The importance of diamond declined, however, because the richer deposits have been depleted.[9] Other mineral resources were being evaluated to determine the feasibility of future development. The mineral industry labor force in

[9] Mineral Resources Division, Ministry of Commerce and Industries. Review of the Mineral Industry of Tanzania for the Year 1968. Dodoma, 1969, 9 pp. This report provided a large amount of information for other parts of this subchapter.

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1966 totaled 9,549 (8,106 surface workers, 1,443 underground); diamond mining employed 2,408, gold mining, 1,764, and tin mining, 1,744.[10]

During the year Soviet geologists assessed the possibilities of establishing a cement factory in the Mwanza area, and of exploring for oil along the coast. More Soviet geologists are expected to arrive in 1969 and prospect for the Tanzanian Government for 4 years under the terms of a technical credit agreement signed in 1967.

Late in 1968 the Government received a report about Tanzania's iron ore resources from a team of Chinese Communists who made the study in early 1966. The contents of the report were not disclosed. Another Chinese Communist team studied the coal resources during the same period, and a report is expected.

PRODUCTION AND TRADE

The value of Tanzania's mineral production, excluding petroleum products, declined to about $25 million in 1968, compared with about $36 million in 1967. Diamond production was valued at about $19 million, down from $31 million in 1967.

In 1967, as in previous years, diamond was the chief mineral export, accounting for $31.2 million as compared with $25.3 million in 1966. All diamond exports were to the United Kingdom. Exports of petroleum products totaled $18.6 million; these were products that were either reexported or made from imported crude oil.

The major mineral imports in 1967 continued to be iron and steel semimanufactures, $17.6 million ($7.1 million in 1966); crude oil, $9.5 million ($3.6 million in 1966); and petroleum refinery products, $5.2 million ($4.4 million in 1966). The value of mineral trade and total trade for recent years follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	25.3	175.8
1966	34.1	221.5
1967	52.8	217.5
Imports:		
1965	15.5	140.1
1966	20.3	179.9
1967	36.1	182.1

COMMODITY REVIEW

Metals.—*Gold and Silver.*—Gold production was largely by Buhemba Mines Ltd. Throughput at the company's mill totaled 57,193 tons in 1968, up from 55,475 tons in 1967. The gold recovered, however, totaled 16,245 troy ounces as compared with 16,861 troy ounces in 1967. Development plans for 1969 include exploring the reef down dip in the north section of the mine. Failure to find more ore in that area would mean that the mine will close at the end of 1969.

Small-scale mining continued in the Geita, North Mara, Nzega, Lupa, and Mpanda areas.

Mineral exploration of the Lake Victoria Goldfield, undertaken jointly by the United Nations Special Fund and the Mineral Resources Division of the Government of Tanzania, was completed in May and a report was being prepared. The Mineral Resources Division drilled in a gold-quartz mineralized area about 20 miles south of Geita. The results indicate the presence of enough gold to make the opening of a small mine a possibility.

Iron and Steel.—During the year the National Development Corporation (NDC) gave the Danielli Group of Italy a $1.5 million contract to build a 10,000-ton-per-year steel rolling mill at Tanga.[11] Scheduled to be operational in 1970, the plant will initially manufacture reinforcing bars and sections; later, an electric melting furnace and a wire drawing plant are to be added. The plant will be operated by National Steel Rolling Mill, Ltd., which is comprised of NDC (80 percent) and the Danielli Group (20 percent).

Tin.—The Kaborishoke mine of Kyerwa Syndicate Ltd. resumed active mining operations under new management in March. Operations had been suspended at the end of 1967 because of declining ore grades and rising production costs. The mine is the country's largest producer of tin concentrate. The ore treated at the mine in 1967 averaged 1.19 pounds tin oxide per ton. The reserves on the company's lease have been estimated to total 15 to 20 mil-

[10] Ministry of Industries, Mineral Resources and Power, Mineral Resources Division. Annual Report 1966. Dar es Salaam, 1969, p. 87.
[11] Metal Bulletin. No. 5328, Aug. 30, 1968 p. 13.

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Table 4.—Tanzania: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content—troy ounces	93,040	90,819	55,473	r 18,528	17,473
Silver, mine output, metal content—do	25,329	22,865	10,572	2,294	2,387
Tin, concentrate—long tons	287	r 330	r 482	467	327
Tungsten, concentrate	-------	-------	r 11	r 48	r 31
NONMETALS					
Abrasives, natural, n.e.s	NA	-------	r 149	-------	-------
Clays:					
Bentonite	5	-------	r 51	208	-------
Kaolin (including china clay)	111	r 167	r 290	312	606
Cement, hydraulic	-------	-------	47,681	r 146,918	156,331
Diamond: Gem and Industrial—carats	668,770	r 756,969	946,656	r 926,757	702,895
Gem stones: [2] Precious and semiprecious, except diamonds—kilograms	956	r 1,849	r 3,000	r 7,679	15,621
Gypsum and anhydrite, crude	2,957	r 6,224	r 3,241	15,479	4,461
Lime (quicklime and hydrated lime)	2,169	r 4,588	r 5,441	5,164	6,950
Magnesite, crude	495	r 1,426	r 4,560	2,038	1,447
Meerschaum	16	r 11	r 5	56	1
Mica:					
Sheet	248	r 104	r 90	[3] 77	72
Scrap	-------	r 168	399	126	239
Quartz, glass sand	-------	-------	-------	1,417	2,089
Salt, all types—thousand tons	33	r 40	r 42	36	30
Stone, ornamental:					
Artstone [3]	457	r 64	11	r 3	3
Amethystine quartz	NA	-------	-------	5	3
Travertine	NA	-------	17	22	-------
Vermiculite	131	98	r 265	91	30
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous—thousand tons	1	2	2	2	3
Petroleum: Refinery products:					
Gasoline, motor—thousand 42-gallon barrels	-------	-------	• 377	911	927
Kerosine—do	-------	-------	• 68	234	251
Jet fuel—do	-------	-------	• 168	322	300
Distillate fuel oils:					
Gas oil—do	-------	-------	• 493	1,424	600
Diesel oil—do	-------	-------			301
Residual fuel oil—do	-------	-------	• 671	1,986	2,212
Liquefied petroleum gas—do	-------	-------	• 20	89	87
Total—do	-------	-------	• 1,797	4,916	4,628

• Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, construction materials such as clay, sand, gravel, and stone are produced, but quantitative data are not available.

[2] Includes amethyst, aquamarine, chrysoprase, corundum, garnet, ruby, sapphire, tourmaline, zircon, and zoisite.

[3] Corundum-zoisite.

lion tons averaging 0.5 pound tin oxide per ton.[12]

Nonmetals.—*Cement.*—Long-range plans were being formulated in 1968 to raise the capacity of the cement plant of Tanzania Portland Cement Co. Ltd. to about 400,000 tons per year by 1974 to meet estimated future domestic needs.[13] The cost of such an expansion would be about $4 million. The plant is at Waza Hills, near Dar es Salaam.

During 1968, the company mined about 250,000 tons of coral limestone and 1,060 tons of gypsum; it purchased about 4,150 tons of gypsum from local producers.

Diamond.—Williamson Diamonds, Ltd., and its two subsidiaries, New Alamasi Ltd. and Kahama Mines Ltd., continued to be the major producers of diamond. Williamson Diamonds Ltd., operating at Mwadui, mined a total of 3.3 million tons of ore averaging 20.1 carats per hundred tons. This represents a decrease in grade of ore as compared with that during 1967—27 carats per hundred tons. The decrease was anticipated in the mining plan. Extensive sampling of the tailings dump showed that recrushing and retreating the tailings would be uneconomical. Although the price of rough gem diamond increased near the end of 1968, the average price per carat

[12] Tanzania Trade and Industry. Tin Mining in Tanzania. No. 22, April/June 1968, p. 35.

[13] Jenga: Magazine of the National Development Corporation. No. 2, 1968, p. 21.

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Table 5.—Tanzania: Exports of mineral commodities to countries outside the East African Economic Community[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metals, including alloys: Semimanufactures	185	148
Gold, metal, unworked or partly worked, troy ounces	55,991	18,486
Iron and steel, metal:		
Scrap	2,320	8,691
Semimanufactures	387	337
Silver, metal, including alloys, troy ounces	10,572	2,293
Tin, ore and concentrate, long tons	487	535
Tungsten, ore and concentrate	11	47
Other, nonferrous metals, scrap	1,119	541
NONMETALS		
Artstone[2]	11	3
Cement	4,607	17,682
Diamond, all grades, carats	905,670	987,605
Gypsum and plasters	1,550	------
Lime	12	7
Magnesite	1,096	------
Mica, all forms	498	266
Precious and semiprecious stone, except diamond:		
Ruby and sapphire, kilograms	241	------
Other, do	2,818	------
Salt and brines	12,491	11,089
Stone, sand and gravel	------	9
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products:		
Gasoline, thousand 42-gallon barrels	32	795
Kerosine, do	5	252
Distillate fuel oil, do	30	728
Residual fuel oil, do	273	813
Other: Asphalt and bitumen, do	------	1

[1] Excludes reexports.
[2] Corundum-zoisite rock; includes rough amethystine quartz.

Table 6.—Tanzania: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys:		
Unwrought	3,403	683
Semimanufactures	348	201
Copper, metal, including alloys:		
Unwrought	------	1
Semimanufactures	105	53
Gold bullion, troy ounces	3,676	556
Iron and steel:		
Ore and concentrate	1,485	1,903
Metal:		
Scrap	21	------
Pig iron, ferroalloys, and similar materials	1,456	1,632
Steel, primary forms:		
Ingots and other	------	205
Semimanufactures	38,689	92,697
Lead, all forms	37	29
Nickel, metal, including alloys, unwrought	1	------
Tin, all forms, long tons	17	21
Zinc, all forms	1,186	1,124
Other, nonferrous metal scrap	177	130
NONMETALS		
Abrasives, natural, n.e.s., grinding and polishing wheels and stones	25	42
Asbestos	------	3
Cement	2,321	3,487
Clays and clay products, refractory products (including nonclay bricks)	------	1,030
Feldspar, fluorspar, cryolite and chiolite	41	------
Fertilizer materials, manufactured:		
Nitrogenous	14,141	11,245
Phosphatic	949	1,188
Potassic	1,358	1,464
Other, including mixed	6,637	8,431
Graphite, natural	8	11
Lime	1,000	840
Mica, crude, including splittings and waste	10	10
Salt and brines	4,443	8,190
Stone, sand and gravel	369	535
Sulfur, elemental, all forms	559	273
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	137	111
Coke and semicoke	163	199
Petroleum:		
Crude and partly refined, thousand 42-gallon barrels	2,116	4,948
Refinery products:		
Gasoline, do	342	267
Kerosine, do	268	69
Distillate fuel oil, do	249	446
Lubricants, do	67	78
Other, do	12	15

realized by the company was less than in 1967 because of a decrease in the average size of the diamond recovered during the year.

The company began prospecting on a license it received during the year to a 50-square-mile area in the Chunya District, where previous bulk sampling of river gravels revealed the presence of microscopic diamonds.

The heavy media plant of New Alamasi Ltd. operated throughout the year; earlier problems had been resolved. It treated a record 623,000 tons and recovered an average of 5.5 carats per hundred tons treated. The unit cost per ton mined and treated was about 4 percent less than that in 1967.

Kahama Mines Ltd. continued to operate at a loss. Compared with 1967 levels, however, the loss was reduced because of

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a decrease in maintenance and operating costs and an increase in the tonnage treated (258,000 tons, compared with 248,000 tons in 1967) and in grade (5.2 carats per hundred tons, compared with 4.7 carats in 1967). The life of the mine is another 2 years.

Other Gem Stones.—During the year, National Development Corporation and International Gems (Luxembourg) made plans to build a gem stone cutting factory at Arusha.[14] The plant will be the first of its kind in the country, and will be a means of increasing foreign exchange earnings by enabling finished gem products to be exported. The official gem valuation and marketing organization that was created by legislation in 1967 had not been established by yearend 1968.

There were no reports of economic finds of tanzanite, a gem variety of zoisite and a new addition to the gem stone family. Small quantities of tanzanite were found in 1967 northwest of Tanga, near the border with Kenya.

Fertilizer Materials.—The National Development Corporation and Kloeckner-Humboldt of West Germany have formed a 60–40 joint venture, Tanzania Fertilizer Corporation, Ltd., to build a $16.5 million, 105,000-ton-per-year fertilizer plant near the Dar es Salaam petroleum refinery. Most of the capital will be provided by Kloeckner-Humboldt as a loan repayable over 13 years at an interest rate of 6 percent. The plant is scheduled to be operating by mid-1970. Annual output will consist of complex NPK fertilizer (45,000 tons), ammonium sulfate (20,000 tons), a diammonium phosphate (15,000 tons), and granulated triple superphosphate (25,000 tons).[15]

Meerschaum (Sepiolite) and Bentonite.—Meerschaum production from the Sinya Mine (Lake Amboseli) reached a new low during the year because mining operations were hindered by a high water table. Although meerschaum and bentonite were produced in 1967 from the salt flats at the southern end of Lake Natron, neither was reported to have been mined in 1968. The mining company, Tanganyika Meerschaum Corporation Ltd., was taking steps to market both commodities.

Salt.—Salt production, particularly from coastal salt works, was greatly hampered during the first part of the year by heavy rains. Salt production along the coast totaled about 6,400 tons, approximately half the 1967 production. Production inland by Nyanza Salt Mines Ltd. rose slightly to about 12,400 tons despite extensive flooding during April and May, which isolated the source of fuelwood used in the evaporation process. The country's stocks of salt were depleted during the year.

Mineral Fuels.—*Petroleum.*—Crude oil throughput at the Dar es Salaam refinery of Tanzanian Italian Petroleum Co. averaged 13,520 barrels per day in 1968, slightly below its rated capacity.

An 8-inch, 1,700-kilometer-long refined products pipeline was completed during the year. It connects the Dar es Salaam refinery with N'Dola in Zambia's copper belt and replaces trucking as a means of transporting oil products from Tanzania to Zambia. The line has a rated capacity of 9,000 barrels per day, but it is designed to carry up to 13,000 barrels per day. There are six pumping stations. Tanzama Pipelines, Ltd. (Tanzanian Government, 33.3 percent; Zambian Government 66.7 percent), will operate the line; the Tanzanian shareholding is to be transferred to the National Development Corporation.

UGANDA

PRODUCTION AND TRADE

Copper mining and smelting remained Uganda's chief mineral industry in 1968. The mineral industry employed an estimated 8,000 persons, including about 6,000 in the copper industry. Mineral production in 1968 was valued at $25.6 million, compared with $29.5 million in 1967. Production of blister copper was valued at $19.4 million, up from $16.5 million in 1967. Mineral exports in 1967 were dominated by blister copper, which was valued at $15.3 million. Mineral imports in 1967 were chiefly iron and steel semimanufactures, which were valued at $5.6 million.

[14] Jenga: Magazine of the National Development Corporation. No. 3, 1968, p. 14.
[15] Jenga: Magazine of the National Development Corporation. No. 2, 1968, p. 21.

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The value of mineral trade and total trade for recent years was as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	28.4	175.6
1966	17.0	184.6
1967	16.8	181.0
Imports:		
1965	8.9	114.4
1966	10.7	120.3
1967	10.8	115.7

In 1968 the Uganda and West German Governments concluded an agreement whereby West Germany will provide technical aid for two projects, one of which is to map Ugandan mineral resources over a 2-year period. The mapping project is expected to cost $840,000.

A group of Japanese industrialists representing Japan's Society of Newer Metals visited Uganda in search for sources of ore of beryllium, columbium, tantalum, lithium, and other minerals. No trade agreements were reported.

Table 7.—Uganda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Beryllium, beryl concentrate, gross weight	394	192	248	314	361
Bismuth, mine output, metal content—kilograms	-------	-------	64	481	1,097
Columbium and tantalum, ores and concentrates, gross weight—kilograms	5,832	8,130	11,180	27,108	•27,000
Copper, metal, blister, primary	18,260	17,141	16,098	14,426	15,597
Gold, mine output, metal content—troy ounces	24	36	3	14	35
Iron and steel, steel semimanufactures—thousand tons	•10	13	22	24	26
Tin, mine output, metal content—long tons	217	178	122	111	228
Tungsten, mine output, metal content	-------	49	71	80	93
NONMETALS					
Cement, hydraulic—thousand tons	73	131	121	139	156
Fertilizer materials: Crude (natural): Phosphates: Apatite	r 174,528	r 196,272	r 170,440	146,719	•142,240
Lime (quicklime and hydrated lime)—thousand tons	12	20	4	185	20
Lithium minerals: Amblygonite	20	20	[1] 71	44	44
Salt, evaporated—thousand tons	3	3	2	NA	-------

• Estimate. r Revised. NA Not available.
[1] Exports.

Table 8.—Uganda: Exports of mineral commodities to countries outside the East African Economic Community [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Beryllium, beryl ore and concentrate	225	315
Copper, metal, blister and other unrefined, unalloyed	15,799	14,975
Iron and steel, metal, semimanufactures	------	591
Tin, ore and concentrate—long tons	204	189
Tungsten, ore and concentrate	106	148
Other, nonferrous metals, scrap	------	988
NONMETALS		
Asbestos	2	24
Cement	3,933	5,522
Salt and brines	1,162	1,641

[1] Excludes reexports.

COMMODITY REVIEW

Metals.—*Copper and Cobalt.*—Kilembe Mines, Ltd., the country's only copper producer and the major mining company, mined about 1 million tons of ore in 1968.[16] The tonnage of ore milled in 1968 rose to 926,760 tons, about 7 percent more than in 1967. The grade of ore dropped, however, from 1.91 percent in 1967 to 1.85 percent in 1968 largely because of a decline in the output of high-grade ore from the Northern Ore Deposit.

Exploratory drilling totaled 92,985 feet as compared with 84,924 feet in 1967. Development work of all types totaled 50,711 feet in 1968, down from 54,300 feet in 1967. Drilling at Bukangama outlined a low-grade mineralized zone near the surface. Drilling and exploratory drives at Buhunga indicated that the area was a promising source of a large amount of ore for the future.

The reserves and tenor of ore in 1968 were as follows: Proved, 4.4 million tons

[16] Kilembe Copper Cobalt Ltd. Annual Report. 1968, 9 pp.

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Table 9.—Uganda: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, semimanufactures	485	376
Copper, metal, including alloys:		
Unwrought	------	17
Semimanufactures	161	75
Gold bullion, troy ounces	3,810	2,745
Iron and steel:		
Metal:		
Scrap	------	6
Pig iron, ferroalloys, and similar materials	580	576
Steel, primary forms, ingots and other	------	500
Semimanufactures	31,870	42,092
Lead, all forms	120	122
Tin, all forms, long tons	26	22
Zinc, all forms	1,804	1,254
Other, nonferrous metal scrap	8	7
NONMETALS		
Abrasives, natural, n.e.s.: Grinding and polishing wheels and stones	18	------
Asbestos	1,439	776
Cement	476	674
Clays and clay products, refractory products (including nonclay bricks)	------	1,886
Feldspar, fluorspar, cryolite, chiolite	1,230	1,520
Fertilizer materials, manufactured:		
Nitrogenous	5,956	7,866
Phosphatic	993	973
Potassic	633	1,499
Other, including mixed	5,248	6,718
Graphite, natural	------	7
Lime	4	3
Salt and brines	32,262	26,337
Stone, sand and gravel	153	774
Sulfur, elemental, all forms	5,989	2,790
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	60	67
Coke and semicoke	17	364
Petroleum: Refinery products thousand 42-gallon barrels	113	156

at 1.92 percent; probable, 1.2 million tons at 2.34 percent; possible, 1.7 million tons at 1.97 percent.

Early in the year, Kilembe Mines, Ltd., announced that it had signed an agreement with Nippon Mining Corporation of Japan for the sale of the entire copper production of Kilembe Mines over a 5-year period beginning in 1968. The copper is to be sold at prevailing world prices; copper exports over the period are estimated to total about $72 million. The agreement reportedly stemmed from talks between the Uganda and Japanese Governments regarding Uganda's adverse trade balance with Japan.

More than 900,000 tons of cobalt concentrates assaying at 1.35 percent cobalt are stockpiled at Kasese.[17] The prevailing low market prices for cobalt make treatment of the concentrates uneconomical. The cobalt is a byproduct of copper mining.

Nonmetals.—*Fertilizer Materials.*—Reserves of phosphate rock have been estimated at 50 million tons at Bukusu and at 130 million tons at Sukulu.[18]

[17] Njonjo, C. E. Kilembe Copper Mines. Sikio: The Staff Newspaper of East African Railways and Harbors, No. 226, June 15, 1969, p. 10.

[18] Journal of Mines, Metals and Fuels (Calcutta, India). V. 16, No. 3, March 1968, p. 95.

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The Mineral Industry of North Korea

By R. A. Pense [1]

North Korea depends heavily on mining and metallurgy to support its moderately industrialized economy, which already possesses well-established heavy machinery and machine tool industries. While few mineral developments of significance took place in 1968, the country continued to be a mineral and metal producer of second-rank importance in the Far East, well ahead of South Korea, although not comparable to mainland China or Japan. In particular, output of graphite, magnesite, and tungsten was again prominent by world standards. Barite, lead, zinc, pyrite and talc-soapstone-pyrophyllite were also of some global importance. Domestically, iron ore and anthracite were significant from the viewpoint of supporting North Korea's medium-scale iron and steel industry.

In the 1968 draft budget of about 5,233 million won, total expenditure on capital construction was to increase 50 percent over that of the previous year. The flowing mineral-related industries were to receive capital allocation increases over 1967 levels, as follows, in percent: Mining and power combined, 60; metallurgy, 160; chemicals, 50; and building materials, 190. Among the few specific construction projects mentioned were several new facilities at the Kimchaek steel plant, iron-producing units at the Kangson steel plant, a stainless steel plant, and a petroleum refinery. Emphasis in mineral industry development seems to have been placed on (1) the continuation of various projects already under construction or previously planned; (2) expansion of outputs from selected mines where the greatest results could be most readily obtained; and (3) the improvement of operating procedures at metallurgical installations aimed at more efficiently using existing equipment and raw materials.

In mining, production increases were to result from accelerated development of several recently constructed apatite (phosphate) mines, the more concentrated working of older sections of a number of coal mines and the sinking of new shafts, and an expansion of iron ore mines in the western part of the country. Overall, great stress was placed upon rock tunneling and open-pit mining. In steelmaking, the adoption of advanced methods of raw material feeding, better furnace heat control, greater employment of oxygen blowing, and use of higher grade refractories were urged. Fuller production from rolling facilities turning out thin steel sheets and tin and zinc plate was demanded. Intensive efforts were directed towards the collection of steel scrap, apparently with some success. Improvement in yields from nonferrous smelters through remodeling and expansion was asked. The cement sector was enjoined to increase capacity and operating efficiency. The fertilizer sector was called upon to raise output more than 50 percent over 1967 output. Throughout all these injunctions the longstanding objective of making North Korea's industry as self-sufficient as possible through better use of indigenous mineral resources, particularly iron ore, anthracite, and apatite, was constantly reiterated.

Geological survey work was pushed with emphasis placed on obtaining immediate results from exploration around existing mines. Special attention was to be given to new coal mines in the west and recently opened nonferrous mines in Hwanghae-

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Pukto Province. Search for large deposits of nonferrous metals, apatite, and high-quality coal were also declared priority tasks.

PRODUCTION

Gross industrial production was scheduled to rise 24 percent in 1968. Although no overall claims were made at yearend, scattered reports indicate that a significant increase did occur. Final results for 1967 allegedly showed that the planned industrial increase of about 13 percent had actually reached 17 percent, the highest annual increase recorded under the present 7-year plan (1960–67), whose termination has been prolonged to 1970. Individual mineral commodities singled out for expansion in 1968 were, with their planned increases over 1967 levels in percent: Pig iron, 36; steel, 33; cement, 20; coal, 20; and fertilizers, 60.

Coal, which had a 7-year plan target of 23 to 25 million metric tons annually, allegedly succeeded in reaching its goal. The 7-year plan objective of 1.5 to 1.7 million tons yearly of chemical fertilizers was not attained in 1968 as hoped for. Overall production of major nonferrous metals, also scheduled to meet undisclosed 7-year targets in 1968, seemingly fell short too. Other major known long-range mineral commodity targets probably approached but not reached in 1968 included 7.2 million tons of iron ore, 2.2 million tons of pig and granulated iron, 2.2 million tons of steel ingots, 1.7 tons of rolled steel, and 4.0 to 4.5 million tons of cement.

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Table 1.—North Korea: Production of mineral commodities[1]

(Thousand metric tons unless otherwise specified)

Commodity[2]	1964	1965	1966	1967	1968
METALS					
Cadmium, mine[3]—metric tons	100	100	100	105	105
Copper:					
Mine	10	10	12	12	12
Electrolytic	10	10	12	12	12
Gold—thousand troy ounces	160	160	160	160	160
Iron and steel:					
Iron ore and concentrate	4,800	5,900	6,000	6,500	7,000
Pig iron[4]	1,340	1,450	1,500	1,750	2,000
Steel ingots	1,132	1,280	1,300	1,450	1,750
Rolled steel	950	1,080	1,100	1,300	1,500
Ferroalloys	80	35	35	45	50
Lead:					
Mine	55	60	60	65	70
Smelter, primary	45	50	50	55	55
Nickel, electrolytic—metric tons	500	1,000	1,000	1,000	1,000
Silver—thousand troy ounces	650	650	650	700	700
Tungsten concentrate—metric tons	4,000	r 4,000	4,500	4,500	4,500
Zinc:					
Mine	100	105	105	115	115
Electrolytic	70	75	75	80	80
NONMETALS					
Apatite	200	200	250	250	300
Barite	70	80	100	r 110	110
Cement	2,610	2,400	2,500	2,600	2,700
Fluorspar	30	30	30	30	30
Graphite	70	70	75	75	75
Magnesite:					
Ore as mined	900	900	1,000	r 1,250	1,250
Clinker	400	400	450	r 600	600
Pyrite	420	450	500	500	500
Salt	400	500	550	550	550
Talc and soapstone	40	50	50	r 60	60
MINERAL FUELS					
Coal:					
Anthracite	11,200	14,500	15,500	17,000	18,500
Bituminous[5]	3,000	3,000	3,800	4,200	4,300
Other	300	300	200	200	200
Total	14,500	17,800	19,500	21,400	23,000
Coke	1,400	1,500	1,500	1,800	2,000

r Revised.
[1] All figures are estimated, except for 1964 iron and steel and coal items.
[2] Many other mineral commodities are produced but reasonable output estimates cannot be made. These include antimony, beryl, bismuth, chrome, cobalt, manganese ore, mineral sands (ilmenite, zircon, columbite, rutile, monazite), minor and rare metals (selenium, tellurium, germanium, indium, silicon), molybdenite, alum, arsenopyrite, asbestos, boracite, clays, kaolin, lepidolite, limonite, mica (phlogopite), and silica (including glass sands).
[3] 80 to 90 percent believed converted to metal.
[4] Includes Krupp-Renn granulated iron.
[5] Includes low-calorie coal, much of which might be classified as low-rank coal.

TRADE

According to the Far Eastern Economic Review, total North Korean commodity trade was estimated at $450 million in 1967. The U.S.S.R., mainland China, and Japan were the principal trading partners. Minerals and metals, including iron and steel items, a number of nonferrous metals (particularly lead, zinc, cadmium, and silver) and various nonmetallics (principally barite, cement, magnesite, magnesia clinker, and talc) remained important export commodities. Petroleum products, coke and coking coal, ferroalloys and ferroalloy minerals, and mineral processing equipment continued to be priority import products. As official trade data were not published by North Korea or by mainland China, imports of most minerals and metals of North Korean origin as reported by the U.S.S.R. and Japan have been used in table 2; their recorded exports to North Korea are discussed separately.

Trade with the U.S.S.R., North Korea's most important trading partner, increased as

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planned in 1967, the first year covered by a 4-year trade agreement. Among the minerals and metals reported by the U.S.S.R. as imported from North Korea, substantially more pig iron, rolled steel, barite, magnesia clinker, and talc were received in 1967 than in 1966. Exports of U.S.S.R. metals to North Korea, with their 1966 quantities in parentheses, included ferroalloys (mostly ferromanganese and ferrochromium), 6,900 metric tons (6,000 tons); steel pipes, 3,100 tons (2,200 tons); other rolled steel, 6,200 tons (3,300 tons); and nonferrous metals and alloys (nearly all aluminum), 2,500 tons (1,500 tons). In addition, about 20,000 tons of manganese ore and 8,000 tons of chromium ore were exported to North Korea for the first time in recent years. Nonmetallics included 2,400 tons of asbestos (1,600 tons), and also for the first time recently, 4,800 tons of sulfur.

Total exports of petroleum products by the U.S.S.R., the principal source of North Korea's liquid fuels supply, in 1967 amounted to about 3,484,000 barrels (3,037,000 barrels in 1966), subdivided as follows: Gasoline, 1,582,000 barrels (1,540,000 barrels); distillate fuel oil, 1,334,000 barrels (1,070,000 barrels); and other, including kerosine, residual fuel oil, lubricants, and paraffin wax, 568,000 barrels (427,000 barrels). Important new mineral fuel items included 72,000 tons of coke and 15,000 tons of coal (presumably bituminous coking grade). These probably reflected North Korea's difficulties in obtaining sufficient coking coal from its former principal source of supply, mainland China.

Under a protocol covering 1967 trade with mainland China, probably still North Korea's second largest trading partner, Chinese coking coal, ferroalloys, steel, and petroleum products were to have been taken in partial exchange for North Korean minerals and cement. There were indications, however, that in 1967 as in the previous year, mainland China was not able or willing to provide these commodities in the quantities desired by North Korea.

Minerals and metals trade with Japan, North Korea's third significant trading partner, became increasingly unbalanced in 1967. While imports by Japan of North Korean mineral commodities—particularly iron and steel items—rose sharply, exports of Japanese products to North Korea remained at virtually the same low level as in 1966. These exports included 5,006 metric tons of coal pitch and 325 flasks of mercury, neither of which was shipped the previous year. As usual, North Korea accounted for almost all of Japan's small ferrovanadium exports (42 tons in 1967 compared with 80 tons in 1966), and took a small amount of ferrochromium (150 tons in 1967 against 100 tons in 1966). In addition, 485 tons of iron and steel products were exported in 1967 compared with 978 tons previously.

North Korea maintains a modest but active minerals and metals trade with Europe. With East European countries, North Korea generally offers nonmetallic minerals (particularly magnesia clinker), rolled steel, and machine tools in return for crude and manufactured fertilizers and mineral processing equipment. Small amounts of nonferrous metals are also exchanged. Poland, the only East European country besides the U.S.S.R. to report trade in detail, recorded the import from North Korea in 1967 of 24,000 tons of magnesite (87,000 tons in 1966), 5,549 tons of fluorspar (1,390 tons), 7,009 tons of talc (10,621 tons), and 927 tons of lead metal (207 tons), and the export of 48,000 tons of coke (25,000 tons in 1966) as well as a small amount of petroleum products. With West European countries, nonferrous metals, especially lead, zinc, and silver, are offered principally for mineral processing machinery. Special United Nations trade data, available only for 1966, show that 7,513 tons of zinc, 628 tons of lead, and an undisclosed quantity of silver valued slightly in exceess of $1 million were delivered to eight West European countries.

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Table 2.—North Korea: Exports of selected mineral commodities to the U.S.S.R. and Japan

(Metric tons unless otherwise specified)

Commodity	U.S.S.R.		Japan	
	1966	1967	1966	1967
METALS				
Cadmium	---	---	14	30
Iron and steel:				
Iron ore	---	---	456,053	526,413
Pig iron	35,400	55,200	164,009	213,928
Sponge and granulated iron	---	---	10,867	23,526
Ferrosilicon	800	1,200	275	1,541
Rolled steel	59,800	79,700	r 701	51,102
Lead and alloys, all forms	13,800	17,000	3,046	617
Silver thousand troy ounces	---	---	374	885
Titanium ores	---	---	226	478
Zinc:				
Concentrate	10,000	2,300	19,404	2,209
Metal and alloys, all forms	8,100	7,700	4,490	2,420
NONMETALS				
Barite	60,800	69,600	280	---
Cement	311,000	256,000	---	---
Fluorspar	---	---	5,250	5,562
Graphite (mostly amorphous)	---	---	4,950	6,429
Magnesia clinker	106,400	158,900	13,605	18,261
Nonmetallic slag	---	---	6,310	14,288
Quartz and quartzite	---	---	1,914	1,960
Soapstone and talc (mostly talc)	16,200	27,400	5,164	4,092
MINERAL FUELS				
Anthracite	---	---	68,094	102,591

Source: Derived from official import statistics of the U.S.S.R. and Japan.

COMMODITY REVIEW

METALS

Iron Ore and Steel.—Despite a lack of specific references to the mining of iron ore in 1968, claims to increased pig iron production during the year indicated a rise in ore output. Deliveries to Japan of 59 percent Fe ore from Musan, the country's leading iron ore mine, totaled 526,000 tons—the same as in 1967. Unyul, probably the second largest mine with a capacity in excess of 1 million tons per year of ore, had been singled out for expansion during economic planning in 1968.

Most of the 1968 steel production increases apparently came from the major Hwanghae and Kangson plants. At the integrated Hwanghae plant, located south of P'yongyang on the southwest coast, the average heat times of the six open hearth furnaces were significantly reduced; the sixth open hearth reportedly recorded the greatest reduction. Other steelmaking facilities at Hwanghae included oxygen and Bessemer converters and electric-arc furnaces. Ore from Unyul and other mines in the western part of the country was the principal raw material for the five blast furnaces. Kangson, located north of Hwanghae, reportedly met its original 7-year plan steel targets (for 1967) during 1968. Capacity of a blooming unit was evidently raised from 360,000 to 480,000 tons annually. Output from a 50,000-ton-per-year steel pipe mill completed in 1964 allegedly doubled that of the previous year. Long-delayed construction work continued on the Krupp-Renn rotary furnaces, aimed at supplementing Kangson's steelmaking electric-arc furnaces and Bessemer converters. The new facilities reportedly will produce 200,000 to 300,000 tons per year of granulated iron, thereby making it the country's third integrated iron and steel plant.

At Kimchaek on the eastern coast, presently North Korea's only other integrated plant, a lack of reporting indicated that no important gains had been made during the year. Work continued, however, on an oxygen converter shop being erected to better complement the plant's two blast furnaces. No new developments were mentioned at either the Songjin plant on the eastern coast near Kimchaek, which produces electric furnace pig iron and special steels, and has several significant rolling

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mills, or the Chongjin plant on the northeastern coast that manufactures Krupp-Renn granulated iron from Musan mine ore.

Nonferrous Metals.—Remodeling and expansion of the three smelters turning out lead, zinc, copper, gold, silver and cadmium—allegedly the country's most important trade commodities—was to proceed in 1968. There were indications that scrap melting was to play a significant part in production increases: At the beginning of the year the Hungnam copper smelter on the eastern coast was said to have "uncovered reserves" sufficient to increase output 69 percent over its 1968 target. However, no results or claims to substantial output rises were made at yearend for Hungnam or for the Munpyong lead-zinc plant on the eastern coast, or the Nampo copper-zinc installation on the western coast. In addition, shipments to Japan of copper and zinc metal, both in sharp demand there throughout 1968, apparently did not increase significantly. No information was available during the year on nonferrous mines.

High world prices during 1968 for cadmium and silver, principally byproducts of lead-zinc smelting, failed to stimulate North Korean sales of cadmium, but resulted in the export to Japan of about 1.3 million troy ounces of silver, about 45 percent more than in 1967. A spot purchase of 10,000 tons of manganese ore, a deficit item in North Korea's mining output, was made in October from India. A scheme for resuming the World War II production of aluminum from indigenous nephelite was again mentioned, but with considerably less emphasis than in previous years.

NONMETALS

Cement.—Among the goals cited for the cement industry in 1968 were the addition of new kilns at existing installations, the construction of a number of modest-size cement plants to serve local needs, and the building of slag-lime cement producing facilities. The production and use in kilns of better grade refractories, singled out as the most efficacious means of increasing output, and the augmentation of crushing and drying equipment, allegedly a particular weakness in the cement-making process, were also emphasized. Additional demands were made for higher operating rates for kilns. Improvements were to be made in the strength and varieties of cement produced, in order to free the country from the necessity of importing special grades and types of cement. Madong remained the largest of the approximately six North Korean cement plants, followed by Sunghori and Haeju. The country's total annual cement capacity was about 3 million tons at yearend 1968.

Fertilizer Materials.—Total output of nitrogenous fertilizers was scheduled to rise 46 percent in 1968. While most of this increase was undoubtedly to come from facilities completed in 1967, work on expanding nitrogenous fertilizer capacity was continuing. Reportedly slated for completion during the year was a 250-ton-per-day urea unit at the Hungnam fertilizer producing center on the east coast. Hungnam, already equipped with one 250-ton urea unit, a 50,000-ton-per-year ammonia synthesis plant, and superphosphate producing facilities, was probably the country's largest producer in 1968 of all types of manufactured fertilizers. Other nitrogenous fertilizers, including substantial amounts of nitrolime, were also being produced at plants at Aoji, Chongsu, and Sunchon in South Pyongan Province. At Aoji, an ammonia synthesis plant similar to that of Hungnam has been started.

Production of more domestic apatite, used in making most of North Korea's phosphatic fertilizers, remained a strong concern among authorities. Development of the relatively new Yongyu and Pungnyon pits was stressed during planning for 1968; expansion work previously begun at the Tongan mines was apparently either completed or continuing. Rumanian assistance was reportedly being given for some of these projects. Nevertheless, modest amounts of phosphate rock were beginning to be imported: After shipping 20,751 tons to North Korea in 1967, the United Arab Republic sent at least 10,000 tons more in 1968.

Magnesite.—Magnesite was identified again in 1968 as a mineral commodity which North Korea ought to develop as much as possible for trading purposes. Concentrated research was declared necessary for reducing the silica content of the clinker produced. An increase was ordered in the capacity of facilities for collecting and processing magnesite ore dust into

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clinker at the Tanchon magnesia clinker plant on the eastern coast. Other known magnesia clinker plants were at Songjin and Chongjin, also on the eastern coast. Most of the magnesite treated at these installations came from the Machon Mountain Range of northeastern North Korea, where extensive and high-grade ore reserves occur. The most important mine producer by far of Machon magnesite remained Yongyang in South Hamyong Province.

Exports of magnesite go principally to Poland and shipments of magnesia clinker largely to the U.S.S.R. Japan is also a smaller but regular recipient of clinker (12,183 tons reported imported in 1968).

MINERAL FUELS

Coal.—In 1968 coal mining apparently became the first mineral industry sector to reach the minimum overall goal set for it (23 million tons annually) in the original 7-year plan. Mines in the coal basin in North Hamyong Province, which produce badly needed high calorific coal, were particularly mentioned as having met their objective. At Yonghung in South Hamyong Province, however, where a new 1.5-million-ton-per-year strip mine had been under development, difficulties were evidently being encountered in boosting output. Major construction projects outlined for 1968 in the mines in South Pyongan Province, the source of most of North Korea's coal, included completion of a vertical shaft at the Anju brown coal mine. Other mines in this area from which greater production had been expected without new investment were the Aoji and Sinyuson brown coal mines. Vertical shafts at the Obong and Hyeam mines (locations not available) were to have been completed during the year.

Petroleum.—Although coal remained the principal primary energy source of North Korean industry, movement towards a greater use of petroleum became more evident during the year, when blueprints for a long-promised Soviet-sponsored refinery were finally initiated. The installation, which will have a capacity of 40,000 barrels daily, is to be located at Sinuiju near the mainland China border in North Pyongan Province. Despite its location, Soviet crude oil will reportedly be the feedstock. Site clearance work was believed underway at Sinuiju. Meanwhile, North Korea continued to import all its needed petroleum products, principally from the U.S.S.R. and mainland China. Under the 4-year U.S.S.R.-North Korea trade agreement which went into effect in 1967, about 3.5 million barrels of petroleum products was imported in 1967.

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The Mineral Industry of South Korea

By R. A. Pense [1] and Jean W. Pressler [2]

South Korea has a small but thriving mineral industry whose recent development has been strongly assisted by foreign (particularly U.S.) investment and assistance. Although significant amounts of anthracite, tungsten, bismuth, fluorspar, graphite and talc-soapstone-pyrophyllite are produced, the mineral base remains limited, especially when compared with that of the more industralized North Korea. Mineral and metal processing industries—principally cementmaking, fertilizer production, fuel briquetting, petroleum refining and steelmaking—have been expanding rapidly in recent years and rival or surpass their North Korean counterparts in several categories.

The rapid progress made in 1968 under South Korea's second 5-year plan (1967–71) encouraged authorities to shorten the plan period for economic objectives by 2 years. Gross national product (GNP) in 1968 was estimated at $4,168 million (1965 constant prices),[3] representing a real increase of 13.1 percent over the 1967 GNP, and easily exceeded the 8.9-percent rise of 1967 and the average 7 percent per year growth rate set for the plan. Manufacturing, particularly the cementmaking and petroleum refining sectors, contributed heavily toward the 1968 growth. Mining, however, actually declined about 2.5 percent in real terms; its estimated value of $63 million constituted only about 1.5 percent of GNP.

In terms of quantity, the mining index fell from 113.3 in 1967 to 99.0 (1965=100.0). Indexes of components of the mining sector and of identified mineral processing industries, on the same base year, were as follows:

	1967 r	1968
Coal mining	120.6	98.2
Metallic mining	104.5	117.7
Nonmetallic mining	87.0	69.0
Petroleum and coal processing	154.2	199.1
Nonmetallic processing (including cement)	144.4	163.3
Base metal processing	148.1	229.6
Metal processing	184.4	248.1

r Revised.

In September the U.S.-based International Mineral Engineers (IME) substantially completed a 5-year contract, sponsored by the Agency for International Development (AID), with the South Korean Government for technical advice and aid to the mining industry. About 550 field examinations of mines and mineral prospects were made, and 504 reports issued. Approximately 23,000 meters of recommended tunneling and shaft sinking were carried out. During exploration programs in which IME participated an estimated 35 million tons of metallic ore reserves was proved, much of this in the Chaun (formerly Hongchon Chaun) iron ore discovery. Assistance to the Government-owned Changhang smelter-refinery, the focus of the nonferrous metal-producing sector, enabled it to finally attain economic viability. Extensive training was given to South Korean nationals in such fields as exploration geology and geophysics, hydrometallurgy and pyrometallurgy, mine development and management, and mine

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[3] Where necessary, values have been converted from Won to U.S. dollars at a rate of Won 270=$US1.

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equipment use and maintenance. Under the IME and other AID-sponsored programs dating back to 1961, an estimated $9.5 million worth of mining equipment was transferred to South Korean Government ownership; this equipment was loaned in turn to some 230 mines. Largely because of the urging of IME, approximately 62 mine mills were erected or enlarged during the contract period.

PRODUCTION

Anthracite, continuing to be the most important crude mineral produced, accounted by value for about 55 percent of 1968 mine output despite an 18-percent decline in quantity. Metals, paced by gold and such export items as tungsten and iron ore, and nonmetals, led by indigenously consumed limestone and salt, shared the remaining 45 percent almost equally. Rising domestic demand stimulated a 46-percent rise in cement production, and demand plus plant expansions increased steel and petroleum refinery product outputs by 14 percent and 98 percent, respectively.

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Table 1.—South Korea: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Antimony, mine output, metal content	---	---	58	66	31
Beryllium, beryl concentrate, gross weight	1,242	1,614	1,884	2,440	3,572
Bismuth, metal [1]	132	r 81	r 98	r 110	102
Copper:					
Mine output, metal content	850	1,143	1,156	1,400	1,201
Metal, refined, including secondary	2,810	2,697	3,872	3,698	4,556
Gold, metal [2] troy ounces	75,791	62,836	60,765	63,337	62,405
Iron and steel:					
Iron ore and concentrate thousand tons	685	735	789	698	830
Pig iron do	7	26	43	e 31	17
Steel, ingots and castings (mostly from scrap) thousand tons	167	190	215	r 320	364
Lead:					
Mine output, metal content	3,682	4,867	7,640	9,684	17,265
Metal	e 40	e 800	1,608	2,987	3,119
Manganese, ore and concentrate, gross weight	4,312	6,691	5,972	7,241	4,221
Molybdenum, mine output, metal content	120	203	299	279	192
Nickel, mine output, metal content	18	1	---	---	NA
Rare earth metals, monazite concentrate, gross weight	---	25	12	13	---
Silver, metal thousand troy ounces	404	434	499	588	611
Tin, mine output, metal content long tons	---	2	33	40	44
Tungsten, mine output, metal content	2,585	2,130	2,056	2,025	2,092
Zinc:					
Mine output, metal content	2,540	7,116	11,693	r 13,649	19,340
Metal: Primary	---	---	1,424	2,548	2,454
Zirconium concentrates (zircon), gross weight	---	1,866	82	5	NA
NONMETALS					
Asbestos	1,272	1,551	623	2,166	3,311
Barite	2,743	1,287	36	---	5
Cement, hydraulic thousand tons	1,242	1,614	1,884	2,440	3,572
Clays, kaolin	60,536	72,244	112,284	102,676	120,626
Diatomite	563	579	275	2,238	2,214
Feldspar	13,684	15,845	15,294	16,817	20,998
Fluorspar, all grades	56,397	39,167	32,008	56,968	46,604
Graphite:					
Crystalline	2,076	2,768	2,161	2,426	1,788
Amorphous thousand tons	262	254	129	61	128
Pyrite and pyrrhotite (including cupreous):					
Gross weight	60	171	3,745	4,411	NA
Sulfur content e	40	57	1,248	1,470	NA
Salt, marine thousand tons	386	669	393	r 612	561
Stone, sand and gravel, not elsewhere specified:					
Crushed and broken limestone thousand tons	2,220	3,090	2,926	3,916	5,653
Stone, not further described do	57	74	100	229	178
Sand (including glass sand) do	50	34	38	44	49
Talc and related materials:					
Pyrophyllite do	46	49	55	67	78
Talc do	44	36	54	56	72
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	315	329	e 400	NA	---
Coal, anthracite thousand tons	9,622	10,248	11,613	12,436	10,242
Fuel briquets, anthracite briquets do	5,976	6,738	e 7,600	e 8,500	6,891
Peat do	62	107	75	r 31	NA
Petroleum refinery products:					
Gasoline and napthas:					
Motor gasoline thousand 42-gallon barrels	583	1,411	2,020	r 2,690	3,938
Naphthas do	---	---	---	492	1,528
Kerosine and jet fuel:					
Kerosine do	316	512	785	1,366	1,975
Jet fuel do	---	421	740	842	1,962
Distillate fuel oils do	1,150	3,076	3,862	r 4,083	7,780
Residual fuel oil do	2,721	4,635	5,236	7,272	16,190
Liquefied petroleum gas do	NA	28	58	r 107	182
Other, including unspecified do	11	33	53	r 272	352

e Estimate. r Revised. NA Not available.

[1] All from indigenously mined ores, virtually all of which are believed smelted domestically.

[2] Officially reported production only.

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TRADE

Total commodity trade rose sharply in 1968, with both the $1,468.2 million of imports and $455.4 million of exports representing new highs. Mineral commodity exports began to recover from the almost complete loss of the South Vietnam steel market and rose about 12 percent over those of the previous year. Nevertheless, minerals still accounted for only about 8 percent of total exports in 1968, compared with 11 percent in 1967 and 16 percent in 1966. Greater demand for steel and petroleum increased mineral commodity imports approximately 17 percent, but these constituted only about 17 percent of total imoprts in 1968 compared with 22 percent in 1967 and 29 percent in 1966. The following tabulation shows these trends and the changes in the major components of mineral trade 1966–68:

	Value (million dollars)		
	1966	1967	1968 p
EXPORTS			
Mineral commodities:			
Metallic ores (mostly tungsten and iron)	20.9	21.6	25.7
Nonmetallic ores	4.7	5.8	6.3
Iron and steel products	8.1	1.9	1.1
Other	4.9	3.6	3.6
Total	38.6	32.9	36.7
Other commodities	210.9	287.3	418.7
Total exports	249.5	320.2	455.4
IMPORTS			
Mineral commodities:			
Iron and steel scrap	r 12.4	r 18.9	22.9
Crude fertilizer materials, including sulfur	1.8	2.9	10.0
Manufactured fertilizer materials	88.9	43.9	30.5
Iron and steel products	39.5	r 56.1	69.2
Nonferrous metals and products	11.2	r 12.5	12.2
Nonmetallic products, mostly cement	r 4.6	r 10.1	4.7
Petroleum and products	40.6	59.4	85.0
Other	r 10.5	r 14.9	20.3
Total	209.5	r 218.7	254.8
Other commodities	527.1	780.8	1,213.4
Total imports	736.6	999.5	1,468.2

p Preliminary. r Revised.

The most important individual mineral export items in 1968 remained tungsten ($11.1 million) and iron ore ($7.3 million), but lead ($2.7 million) and zinc ($1.9 million) ores also assumed some significance. Imports of iron and steel scrap rose again in response to increased electric-arc furnace steel capacity and production, as did imports of steel semimanufactures used by the expanding rolling mills. Fuller operation of four fertilizer plants completed in 1967 was mainly responsible for a large increase in imports of crude fertilizer materials (phosphate rock, $6.5 million and sulfur, $3.5 million), and the concomitant drop in purchases of manufactured fertilizers. Petroleum imports, consisting principally of crude oil, increased markedly with the doubling of capacity at South Korea's one refinery.

South Korea's principal trading partners in 1968 remained the United States and Japan. Of the country's total commodity import trade approximately 31 percent, valued at $453.0 million and including most of the iron and steel scrap, phosphate rock and nonferrous metals, and 53 percent of the product export trade, valued at $253.5 million, was with the United States. Of commodity imports, Japan accounted for about 43 percent valued at $624.1 million, which included most of the iron and steel products and about half of manufactured fertilizers, but only about 22 percent of its exports, valued at $99.7 million and including most of the metallic and nonmetallic ores.

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Table 2.—South Korea: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Bismuth metal, including alloys, all forms	84	99	Belgium 46; United Kingdom 21.
Iron and steel:			
Iron ore and concentrate	641,358	668,391	Japan 667,491.
Metal, powders	6,080	1,400	All to Japan.
Semimanufactures	33,718	9,576	South Vietnam 7,041; Japan 2,258.
Lead ore and concentrate	11,772	12,821	Japan 12,612.
Manganese ore and concentrate	620	367	Japan 316.
Molybdenum ore and concentrate	1,028	514	Japan 415; United Kingdom 51.
Rare earth metals ore and concentrates	97	102	Mainly to Japan.
Silver, metal, including alloys, all forms—thousand troy ounces	322	225	United Kingdom 193; Japan 32.
Tin ore and concentrate—long tons	16	36	All to United Kingdom.
Titanium ore and concentrate	25	-------	
Tungsten:			
Ore and concentrate	3,760	3,990	Japan 1,814; United Kingdom 696; West Germany 513.
Metal, including alloys, all forms	12	8	Denmark 5; Canada 3.
NONMETALS			
Abrasives, flint pebbles	4,577	12,443	Japan 12,203.
Cement	24,704	5,315	All to South Vietnam.
Clays and clay products:			
Crude clays, n.e.s., kaolin	28,466	26,358	Japan 25,198.
Products, refractory	17,849	47,287	Mainly to Japan.
Diatomite and other infusorial earths	90	307	Japan 305.
Feldspar and related materials:			
Feldspar	1,650	2,710	Taiwan 2,070; Japan 610.
Leucite, nepheline, nepheline syenite	11,138	25,572	Japan 23,954; Taiwan 1,608.
Fluorspar	39,218	48,182	Japan 46,193.
Graphite, natural	56,069	51,231	Japan 45,670.
Mica, all forms	518	592	All to Japan.
Stone, sand and gravel:			
Dolomite, chiefly refractory grade	13,205	11,587	All to Japan.
Gravel and crushed rock	20,308	12,678	South Vietnam 10,098; Japan 2,530.
Quartz and quartzite	46,913	96,997	Japan 96,796.
Talc and soapstone	41,085	57,862	Japan 33,054; Netherlands 15,045.
MINERAL FUELS AND RELATED MINERALS			
Coal and briquets:			
Anthracite and bituminous coal	62,464	172,068	Japan 171,068.

Source: Foreign Trade of Korea, 1966 and 1967. Customs Bureau, Ministry of Finance.

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Table 3.—South Korea: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum, metal, including alloys, all forms	10,046	12,394	United States 7,435; Japan 1,614.
Copper, metal, including alloys, all forms	1,152	3,466	United States 2,309; Japan 611.
Iron and steel:			
Metal:			
Scrap	195,624	313,074	United States 305,855.
Pig iron	51,227	46,415	Republic of South Africa 24,424; Brazil 10,000.
Spiegeleisen	-------	3,000	All from Singapore.
Steel, primary forms	13,357	42,319	Japan 32,350; India 9,910.
Semimanufactures:			
Bars, rods, angles, shapes, sections	38,556	64,144	Japan 56,194; France 4,006.
Universals, plates and sheets	154,940	174,293	Japan 164,854; United States 4,357.
Hoop and strip	20,170	12,805	Japan 12,799.
Rails and accessories	49,888	18,735	Japan 15,151.
Tubes, pipes and fittings	104,374	46,491	Japan 37,598; France 7,314.
Other	1,353	1,969	Japan 1,810.
Lead, metal, including alloys, all forms	3,787	1,260	United States 477; Australia 294.
Manganese:			
Ore and concentrate	950	7,197	Philippines 4,577; Japan 1,854.
Oxides	226	452	Japan 402; Thailand 50.
Mercury, 76-pound flasks	-------	323	Japan 223; United States 100.
Tin, metal, including alloys, all forms	long tons 214	201	United States 99; Japan 81.
Titanium:			
Ore and concentrate	170	287	Australia 283.
Oxides	1,677	2,144	United States 1,749; Japan 371.
Zinc, metal, including alloys, all forms	6,856	4,645	Japan 4,179.
NONMETALS			
Asbestos	12,070	22,033	Canada 11,173; United States 9,189.
Cement	177,615	467,745	Japan 467,789.
Diatomite and other infusorial earth	3	60	All from Japan.
Fertilizer materials:			
Crude:			
Phosphatic	12,190	42,683	United States 42,679.
Potassic	20,943	122,187	United States 114,723; Japan 7,464.
Manufactured:			
Nitrogenous	287,372	280,897	Japan 249,417; United States 31,355.
Phosphatic	339,046	312,477	United States 251,041; Japan 52,158.
Potassic	315,360	28,904	United States 28,903.
Other	27,533	4,508	Japan 4,506.
Gypsum and plasters	71,384	82,273	Mexico 59,179; United States 13,805.
Sulfur, elemental, all forms	22,040	36,894	Canada 27,258; Japan 5,921.
MINERAL FUELS AND RELATED MINERALS			
Coal, all grades, including briquets	63,865	56,811	Japan 29,507; Australia 27,304.
Coke and semicoke	27,251	31,600	All from Japan.
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels 14,130	18,371	Mainly from Iran and Kuwait.
Refinery products:			
Gasoline	do	163	350	Mainly from Japan.
Kerosine	do	28	367	NA.
Distillate fuel oil	do	433	513	Mainly from Kuwait.
Residual fuel oil	do	1,687	5,835	NA.
Lubricants	do	162	NA	
Other	do	NA	92	NA.

NA Not available.
Source: Foreign Trade of Korea, 1966 and 1967. Customs Bureau, Ministry of Finance; Korea Oil Company.

COMMODITY REVIEW

METALS

Copper, Lead, Silver, and Gold.—The Changhang custom smelter of the Government-owned Korea Mining and Smelting Corp. in 1968 produced 4,077 tons of copper, 3,119 tons of lead, approximately 561,000 troy ounces of silver, and 24,885 troy ounces of gold. These constituted 90 percent, 100 percent, 88 percent, and 40 percent respectively of the national output totals of these metals. Because of a continuing shortage of copper ores for smelting at Changhang, about 6,800 tons of concentrates were imported from Japan and the Philippines.

The most important producers of copper concentrates were the recently renovated

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Kunbuk copper mine (2,672 tons) and the Dalsang copper-tungsten mine (2,644 tons). Benefiting from a recent development program, the Yeong Hwa lead-zinc mine of Young Poong Mining Company, Ltd. (Young Poong), more than doubled its output of lead concentrates. Most of the slightly over 22,000 tons of output, representing about 70 percent of the national figure, was exported to Japan. In addition to the Changhang smelter, other significant suppliers of the officially recorded gold production were the Kubong (13,100 troy ounces) and Muguk (12,000 troy ounces) mines of the Daimyong Mining Co. Muguk was also a relatively important producer of silver (13,700 troy ounces), but it was outranked by Dukeum (42,300 troy ounces).

Iron Ore.—Production, geared largely to supplying the Japanese market, rose sharply in 1968. Total domestic ore consumption in 1968 was estimated at only 120,000 tons, slightly less than 15 percent of output. Although the Yangyang mine (322,000 tons) was again the largest producer, the second ranking Mulkum mine (206,000 tons), currently undergoing development of a fourth underground level, was expanding output faster. During the year the Government-owned Daihan Iron Mining Corp., which operates both mines, sold stock to the public and became a wholly private concern. The Chungju mine of Young Poong (116,000 tons) remained the third producer of note. Extended diamond drilling of the undeveloped Chaun deposit, previously declared by U.S. experts as submarginal for exploitation, uncovered in early 1968 about 3.5 million tons of slightly higher grade ore (38 percent iron) allegedly amenable to open pit extraction and milling. At yearend exploration was continuing, and the property owner was negotiating a sales contract with the Inchon Steel Company, Ltd., at Inchon for the delivery of up to 120,000 tons of 60 percent iron ore annually.

Iron and Steel.—Hopes for a quick start on the projected integrated iron and steel plant at Pohang dimmed in 1968, as critical negotiations for financing failed to produce meaningful results. Meanwhile, a Stelco-Lurgi/R-N (SL/RN) process rotary kiln went on stream in the latter part of the year at the now privately owned Inchon Steel plant, making it actually the country's first integrated producer. The new unit produces up to 125,000 tons annually of sponge iron (70 to 80 percent iron) from low-grade domestic iron ores. The sponge iron is then refined in Inchon Steel's existing electric furnaces before being fed into an open hearth whose capacity was recently increased by the addition of oxygen lancing equipment.

Significant new electric furnace capacity was added at the recently-opened Masan plant of Korea Iron and Steel Co., and the Pusan plant of Kuk Dong Steel Co. Each installed a 60-ton-per-charge electric furnace with an annual capacity of 60,000 tons. In addition, Kuk Dong combined with Dong Kuk Steel Co. of Seoul to take control of the Pusan Steel Co. in an attempt to rival with their 250,000-ton-per-year capacity the size of the Korea Iron and Steel Co.

Near yearend a $5.3 million contract was signed with Japanese interests for the installation of a stainless steel mill near Inchon. This plant, along with a 4,200-ton-per-year ferrosilicon plant completed in 1967 at Masan, was a key item in the current 5-year plan and was to process annually hot-rolled coils from Japan into 12,000 tons of plates.

Tungsten.—A 6-year decline in production was halted, when output rose 7 percent at Sangdong, the world's foremost producer of mine tungsten. The 3,768 tons of scheelite concentrates produced there accounted not only for 83 percent of the national output, but also for an estimated 7 percent of the world total.

Zinc.—Principally because of the vigorous expansion of the Yeong Hwa mine, which produced and shipped to Japan 21,732 tons of concentrates during the year, output of mine zinc rose 42 percent. In addition to Yeong Hwa, which accounted for 56 percent of the national total, other relatively important concentrate producers were Ulchin (7,891 tons) and Sinyemi (4,341 tons). Completion during the year of a new adit and expansion of Ulchin's flotation mill capacity from 200 to 250 tons of ore daily were believed the reasons for a sharp increase in 1968 output from Ulchin, which is now developing into a significant producer of copper and lead as well as zinc. The rise of Sinyemi to modest importance followed its reopening in 1967 after a long period

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of dormancy and the expansion of its milling capacity to treat 200 tons daily of 6 percent zinc ore. In addition to 51 percent zinc concentrate, the mill also produces byproduct copper and molybdenum.

All of the country's zinc metal continued to be produced at the small electrolytic refinery of Tongshin Industries, Ltd. For lack of ores, however, this custom facility again worked at only about half of its 5,000-ton-per-year capacity during 1968. Nevertheless, at Yeong Hwa, Young Poong was planning to erect with the assistance of Toho Zinc Co., Ltd. of Japan a $4.1 million, 10,000-ton-per-year electrolytic zinc refinery; 20,000 tons of sulfuric acid is also to be produced in associated facilities.

NONMETALS

Cement.—The cement industry, whose production rose sharply during the first half of the year, received a major capacity addition in the second half, when the 1.7-million-ton-per-year plant of the Ssangyong Cement Co. went on stream near Samchok. This brought total Ssangyong capacity to 2.4 million tons annually—the largest in South Korea—and national capacity to about 4.8 million tons. Imports of ordinary cement dropped to 125,000 tons, less than one-third of the previous year's amount. The lack of domestic gypsum supplies, however, necessitated the importation of slightly over 100,000 tons of this commodity.

Fluorspar.—Production of fluorspar, the largest single portion of which came from the Kumi mine (10,093 tons), fell 18 percent in 1968 despite rising world prices. The 49,372 tons exported mostly to Japan was slightly more than the previous year and brought $1.1 million.

Graphite.—Shiheung mine, with an output of slightly over 1,000 tons, was again the most important producer of the high-value crystalline graphite. However, overall production declined 26 percent, because of Japanese restrictions on its importation. The 943 tons shipped entirely to Japan earned only about $107,000, a sharp drop from the previous year's level. This decline was only partially compensated for by the somewhat higher prices obtained from Japanese briquet-makers for the low-value amorphous graphite ($829,000 for 45,444 tons). The most significant sources of amorphous graphite, whose doubled output reflected principally greater internal demand, were Bongmyong (50,391 tons), Wolmyong (24,954 tons), and Changja (21,919 tons).

Talc and Pyrophyllite.—Production of both the high-value talc and the lesser value pyrophyllite responded favorably to heightened internal demand with 29-percent and 16-percent increases, respectively. Tongyang, with 49,687 tons, remained by far the most important talc source, while Sungsan (12,342 tons) continued to be the largest single producer of pyrophyllite. All of a reduced quantity of exports went to Japan, where the 48,679 tons of talc brought a record $1.6 million and the 28,801 tons of pyrophyllite an additional $209,000.

MINERAL FUELS

Coal.—Production slumped sharply in 1968, despite palliative measures adopted in late 1967 to slow the decline. Nevertheless, coal continued to be South Korea's largest single source of primary energy, meeting 40 to 50 percent of total demand. Households accounted for an estimated three-quarters of coal consumption, mostly in the form of briquets. A study completed by the Korea Institute of Science and Technology in 1968 concluded that the principal market for the country's coal during the next decade would be in the household sector. With the possible exception of mine-mouth powerplants, both petroleum and atomic power were expected to either limit or displace coal in other consuming categories.

At Changsong, the largest coal mine in the country with a 1968 production at 1,981,000 metric tons, the U.S. agency for International Development assisted continuing work on the expansion of the main shaft. Because of a schedule revision in September which increased the extent of the project, only about 83 percent of the job was reported completed at yearend.

Petroleum.—Despite the discouraging history of prospecting in South Korea, exploration received new impetus in 1968 with offshore investigations. Near midyear an airborne magnetic survey coordinated by the Geological Survey of Korea and the U.S. Navy was conducted over the Yellow Sea adjacent to the country. While results were not revealed, near yearend at least three international oil companies were known to be discussing with the Govern-

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ment offshore exploration along the country's continental shelf. Each reportedly was prepared to invest about $15 million in conjunction with a South Korean partner. Among the joint ventures mentioned were combinations of Gulf Oil Corp. with the Government-owned Korea Oil Corp. to explore off the west coast in the Yellow Sea, the California Texas Oil Corp. with Lucky Chemical Co. to investigate off the south coast in the Korea Strait, and a Royal Dutch/Shell subsidiary with Kukdong Oil Corp. to explore south of Cheju Island in the East China Sea.

In other related activities, Royal Dutch/Shell acquired a 50-percent interest in Kukdong's existing 3,000-barrel-per-day lubricating oil plant at Pusan with the intention of enlarging it to 20,000 barrels per day, and Gulf—already a minority partner with Korea Oil in the country's sole operating refinery at Ulsan—was negotiating with Korea Oil to build a new 3,000-barrel-per-day lubricating oil plant at Ulsan, in which Gulf will have a 25-percent interest.

Several important developments took place in petroleum processing during the year. A 60,000-barrel-per-day expansion of the Ulsan refinery was completed by Japanese contractors in June, and at year-end the installation was operating near its new 115,000-barrel-per-day capacity. Construction continued on the 60,000-barrel-per-day Yosu refinery of the Honam Oil Refining Co., Ltd., with completion set for early 1969. Protracted negotiations between Union Oil Corp. and the Government over the building of a topping unit and associated powerplant at Inchon were believed approaching a successful conclusion near yearend. The topping unit is reportedly to be designed to process 50,000 barrels per day of crude oil into fuel oil for the powerplant and naphtha for export.

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The Mineral Industry of Kuwait, Kuwait-Saudi Arabia Neutral Zone, and Saudi Arabia

By David A. Carleton [1]

CONTENTS

	Page		Page
Kuwait	473	Saudi Arabia	478
Kuwait-Saudi Arabia Neutral Zone	477		

KUWAIT

Attempts to diversify Kuwait's petroleum dominated economy as proposed in a 5-year development plan (1967–72) have been marginally successful. Projects involving nonpetroleum mineral developments, however, were meager because the country's resource base is extremely limited. Most government-financed industrial development has centered on infrastructure, such as waterplants and powerplants. A synoptic geological survey of Kuwait's natural resources, completed in 1967–68, revealed that apart from petroleum and natural gas the only known mineral resources of current economic value were gravel aggregate, oolitic limestone as a source for calcium carbonate, and sand-lime for brick manufacture. No magmatic or metamorphic rocks were found at or near the surface except as minor constituents of conglomerates.

Petroleum production continues to buttress the economy as production and government revenue therefrom increased to record levels in 1968. Direct income from petroleum operations accounted for about 50 percent of gross national product (GNP) that year. During fiscal year 1967–68 revenues, which totaled an equivalent of $670 million, provided more than 93 percent of all government income and foreign exchange earnings. GNP increased 4.5 percent during 1968, well under the previous 5-year average rate of 6.5 percent. Though respectable, the growth rate has been dampened by the drain on resources to support other Arab states and some pessimistic forecasting of Kuwait's future petroleum production.

During recent years, increasing amounts of government revenue have been earmarked for the Shuaiba Industrial Development Board which coordinates government projects centered at Shuaiba, 30 miles south of Kuwait City near the large oil complex at Mina al Ahmadi. Now operative at Shuaiba are a refinery, a chemical fertilizer plant, and facilities for producing oil well chemicals (drilling mud). Planned for completion in 1971 is another petrochemical plant. Other mineral industries in Kuwait include a cement clinker grinding plant, a barite grinding plant, the petroleum facilities of Kuwait Oil Co. Ltd. (KOC), and the Mina Abdullah refinery of American Independent Oil Co. (Aminoil), a concessionaire in the Kuwait-Saudi Arabia Neutral Zone.

During the year Kuwait's Minister of Finance and Oil publicly announced that the Government was now actively interested in participating in the ownership, operation, and foreign marketing of petroleum produced by concession-holding com-

[1] Supervisory foreign mineral specialist, Division of International Activities.

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panies in Kuwait. Thus far no companies have been mentioned and no formal requests made; however, the approach is in keeping with a resolution adopted by the Organization of Petroleum Exporting Countries (OPEC) in 1968.[2]

PRODUCTION

Crude oil production by KOC, the sole producing company in Kuwait proper, averaged 2,421,107 barrels per day in 1968. This represents a 5.6-percent increase over that of the previous year and compares favorably with the growth of only 0.7 percent in 1967 and 4.9 percent in 1966.

Relative to previous years, the high rate of growth in 1968 represents the efforts of KOC to meet commitments the company gave the Government to increase production by 6 percent. Relative to other major Middle East producing countries, Kuwait's growth rate has been sluggish, primarily the result of foreign market demands.

Other major mineral production in 1968 included 23 million sand-lime bricks, down considerably from 48 million (valued at $2.2 million) in 1967. Output in 1967 and 1968 of lime was 1,075 and 893 tons, respectively, while that for evaporated salt was 3,756 and 4,211 tons, respectively. Production of chemical fertilizers in 1967 totaled 107,000 tons.

Table 1.—Kuwait: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968
Crude petroleum	774,816	791,903	830,587	836,719	886,125
Petroleum refinery products:[1]					
Motor gasoline	1,625	1,901	2,668	2,678	NA
Jet fuel	202	224	357	393	NA
Kerosine	345	335	335	363	NA
Distillate fuel oil	20,284	19,766	21,171	18,530	NA
Residual fuel oil	r 65,776	r 64,930	r 64,148	r 60,410	NA
Liquefied petroleum gas [2]	2,886	4,030	7,969	r 8,591	NA
Other refinery products	r 15,772	r 18,332	r 18,265	19,490	NA
Total	106,890	109,518	114,913	110,450	• 115,000
Refinery fuel and loss	r 2,866	r 1,112	• 1,100	r 1,116	NA

• Estimate. r Revised. NA Not available

[1] Includes output from KOC and Aminoil refineries and, beginning in 1968, Kuwait National Petroleum Refinery Co.

[2] Includes production of natural gas process plant.

TRADE

During the period 1954–65, Kuwait was the world's second largest crude oil exporting country, after Venezuela. In 1966 and 1967 Kuwait's crude exports were exceeded by those of Saudi Arabia and Iran, and in 1968, by Libya. Kuwait's declining position is the result of several factors including the high sulfur content of Kuwait crude, closure of the Suez Canal, increased refinery runs in Kuwait, and the few market outlets in Asia and the Far East by the KOC owners, British Petroleum Co. Ltd., and Gulf Oil Corp. Crude oil exports which totaled 792.4 million barrels in 1968, were distributed as follows: United Kingdom, 148.7; Italy, 132.7; Japan, 115.4; Netherlands, 93.7; France, 69.7; Australia, 35.5; Singapore, 28.5; United States, 20.6; and other, 147.6. Kuwait has no major mineral exports other than petroleum.

Construction materials are the major mineral commodities imported. Increases in recent years of imports of cement and steel semimanufactures reflect construction of the large Shuaiba refinery. Receipts of crude oil from the Neutral Zone to the Mina Abdullah refinery in Kuwait were equal in value to approximately one-third of the country's total mineral imports. Mineral and total trade balances for 1966 and 1967 are given in the following tabulation:

[2] Petroleum Intelligence Weekly. Oct. 14, 1968, p. 4.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966 r	1,405	1,452
1967	1,408	1,444
Imports:		
1966 r	121	505
1967	109	628
Trade balance:		
1966 r	1,284	947
1967	1,299	816

r Revised.

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Table 2.—Kuwait: Exports of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1966	1967	1968
Crude petroleum	750,367	755,203	792,421
Petroleum refinery products: e			
Gasoline	762	899	NA
Kerosine	-------	48	NA
Light distillate, unfinished	15,499	16,031	NA
Distillate fuel oil	19,595	16,912	NA
Residual fuel oil [1]	r 36,275	34,482	NA
Other	r 400	330	NA
Total	72,531	68,202	r 76,806
Liquefied petroleum gas [2]	NA	11,409	15,891

e Estimate. r Revised. NA Not available
[1] Includes some bunkers from Mina Abdullah.
[2] KOC only.
[3] Propane, butane, and natural gasoline from natural gas process plants.

COMMODITY REVIEW

Nonmetals.—*Fertilizer Materials.*—A fertilizer plant producing ammonia, ammonium sulfate, sulfuric acid, and urea was completed in 1966 for Kuwait Chemical Fertilizers Co., in which Kuwait Petrochemical Industries Co. (KPIC) (a government controlled company) owns 60 percent, Gulf Oil Corp., 20 percent, and British Petroleum Co., Ltd., 20 percent. Export outlets are Iraq, Sudan, and India. KPIC has received approval to build two ammonia units having a combined capacity of 1,600 tons per day. One-half will be converted to urea in a 1,400-ton-per-day unit and exported while the remaining ammonia will be transported in liquid form in tankers to Mersin, Turkey, where KPIC is participating in the construction of a fertilizer plant.[3]

Mineral Fuels and Related Materials.—*Petroleum.*—Although production increases have not kept pace with those of other Middle East countries, Kuwait continues as a major supplier of crude oil. In 1968 the country ranked seventh in production, contributing 6.3 percent of world output. During that year Kuwait ranked fifth in crude oil exports, being passed up by Libya for the first time.

Reserves in Burgan field, the world's largest, and other fields totaled 69 billion

Table 3.—Kuwait: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Aluminum and alloys [1]		583	1,299
Copper and alloys [1]		298	198
Iron and steel:			
Scrap and unwrought		r 1,345	26,123
Semimanufactures		191,066	245,668
Lead and alloys [1]		150	311
NONMETALS			
Asbestos sheets		3,065	2,364
Barite compounds		r 26,975	34,132
Cement		729,123	1,048,588
Diamond	carats	-------	905
Gypsum and limestone		8,308	11,171
Marble		7,382	4,484
Salt		1,400	1,074
MINERAL FUELS AND RELATED MATERIALS			
Coal, coke and briquets		r 216	377
Crude petroleum	thousand 42-gallon barrels	25,273	22,138
Petroleum refinery products:			
Gasoline	do	15	14
Liquefied petroleum gas	do	r 251	363
Lubricants	do	104	126
Asphalt	do	28	67
Total	do	398	570

r Revised.
[1] Sheets, bars, and pipes.

[3] Petroleum Press Service. V. 36, No. 4, April 1969, p. 133.

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barrels at yearend 1968, or 15 percent of the world total. In 1968 KOC drilled a well to test deeper formations in the Burgan field and others are planned for 1969. No discoveries have been announced in recent years.

Although other companies and interests are now involved in the petroleum industry of Kuwait proper, KOC remains the only crude oil producer, the major refiner, and the principal exporter. A highlight of the year was the production of the 10 billionth barrel of oil (excluding Neutral Zone share) since the beginning of production, the fourth nation to reach this level. Production increases were facilitated by the construction of huge storage tanks, several new gathering centers, and several new pipelines.

The major construction accomplishment of KOC in 1968 was completion of a new crude oil and bunker loading sea island terminal in 95 feet of water nearly 10 miles offshore from Mina al Ahmadi. Designed to handle the world's largest tankers, the facility consists of two berths served by a 48-inch line for crude oil and a 20-inch line for bunker fuel. Maximum pumping rates are 15,000 and 800 tons per hour, respectively. Bunkering of vessels engaged in international trade increased 11 percent in 1967 to a total of 27,390,000 barrels, 98 percent of which was residual fuel oil.

The operations in the offshore concession area held since 1961 by Kuwait Shell Petroleum Development Co., Ltd., remained suspended pending clarification of offshore boundaries with Iran, Iraq, and Saudi Arabia.

The Kuwait National Petroleum Co. (KNPC), owned 60 percent by the Kuwait Government and 40 percent by Kuwait private interests, continued to gain stature by becoming an exploration concessionaire and a refiner. On April 30, 1968, the Kuwait National Assembly ratified a joint oil concession venture between KNPC and the Spanish company, Hispanica de Petroleos, S.A. (Hispanoil). The joint operating company Kuwait-Spanish Petroleum Co. (KNPC 51 percent and Hispanoil 49 percent) was organized and at yearend geophysical work was underway. The 3,575-acre concession covers an area relinquished by KOC in 1962.

In August 1968, the 95,000-barrel-per-day KNPC refinery at Shuaiba was completed. The new plant called an "all hydrogen refinery" represents the latest in petroleum refinery technology. Catalytic hydroprocessing is involved in every unit downstream from the two-stage distillation unit. The plant which supplies hydrogen has a rated input capacity for processing associated natural gas of 140 million cubic feet per day. The refinery which employs both hydrocracking and hydrotreating, is designed to process the heaviest crude oil in Kuwait (Umm Gudair having a gravity of 26° API). Jobsite work which began in early 1966 was delayed slightly by the Middle East conflict in 1967 and floods in 1968. At the peak of construction 3,000 people were employed and in total more than 9,000 worked at the site. Equipment and materials were purchased from seven countries including Kuwait which supplied basic building materials, spiral-welded pipe, and paint. Capacity of principal units are as follows in barrels per day: Distillation, 95,000; gas-oil hydrocracking, 14,400; residium hydrocracking, 24,000; catalytic reforming, 15,800; hydrotreating (four units), 81,840. The sulfur unit is capable of recovering 520 long tons per day and total crude oil storage capacity is 5 million barrels.

Aminoil completed a $25 million expansion project at its Mina Abdullah refinery in Kuwait during 1968 raising the distillation capacity to 144,000 barrels per day and added a 35,000-barrel-per-day Isomax desulfurization unit. The latter unit which will reduce the sulfur content of residual fuel oil to less than 1 percent making it more desirable in sulfur-conscious industrialized nations. Included is a hydrogen plant to process 39 million cubic feet of associated natural gas a day and a 325-ton-per-day sulfur recovery unit.

Natural Gas.—Kuwait continues to produce larger quantities of natural gas in association with the crude oil output and to utilize larger shares of that production. Production averaged 1.3 billion cubic feet per day in 1968 compared with 1.2 billion cubic feet per day in both 1967 and 1966. The amount used in 1968 was an estimated 360 million cubic feet per day or 28 percent of total production, up from 27 percent in 1967 and 21 percent in 1966. The increase in utilization reflects completion of injection plants, supply to petrochemical plants, and deliveries to the hydrogen plant at the new KNPC refinery. KOC continues as the major consumer.

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KUWAIT-SAUDI ARABIA NEUTRAL ZONE

Petroleum is the only commercially exploited mineral resource in the Kuwait-Saudi Arabia Neutral Zone. A recently completed geological survey of the northern half of the Neutral Zone revealed substantial outcropping of oolitic limestone and recommended that detailed investigations and analyses be made to determine the suitability of these deposits for cement manufacture. The petroleum industry continued to maintain its world positions by ranking 13th in production and 10th in reserves.

Payments to the Governments of Kuwait and Saudi Arabia in recent years by petroleum companies have gradually moved upward to about $50 million for each in 1967. Payments in 1968 were expected to jump considerably, a result of final agreements between each of the Governments and their onshore concessionaires. The agreements, *inter alia,* involve the expensing of royalties in accordance with the formula of the Organization of Petroleum Exporting Countries (OPEC). The increased payment rate is retroactive to January 1, 1964. Talks between the Governments and the offshore petroleum concessionaire were in the preliminary stages at yearend. Since the concession, as originally concluded, includes the expensing of royalties, discussions have centered around discounts and prices.

PRODUCTION

Following a trend established in 1965, onshore crude oil production continued to fall while offshore production continued to rise. Offshore increases in 1968, however, exceeded the onshore decline with the result that total production rose 3 percent in 1968, in contrast to a 1-percent decline in 1967. Offshore production by the Japanese-owned Arabian Oil Co., Ltd. (AOC) amounted to about 301,000 barrels per day during 1968 while that of the joint operation onshore by Aminoil and Getty Oil Co. totaled 127,000 barrels per day.

Table 4.—Kuwait-Saudi Arabia Neutral Zone: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968 •
Crude petroleum	131,416	132,285	153,432	151,461	156,720
Petroleum refinery products:r [1]					
Distillate fuel oil	4,617	7,519	3,404	3,242	NA
Residual fuel oil			4,355	5,932	NA
Other [2]	456	765	833	1,421	NA
Total	5,073	8,284	8,592	10,595	NA
Refinery fuel and loss r	247	269	270	277	NA

• Estimate. r Revised. NA Not available
[1] Excludes output from Aminoil refinery in Kuwait.
[2] Mostly naphtha.

TRADE

All of Aminoil's share of onshore crude oil production was shipped to Mina Abdullah in Kuwait where nearly all was refined prior to export. All of the Getty share of onshore production was piped to Mina Saud on the coast where most was exported; the remainder was exported after refining. Offshore AOC production was exported to either Japan or Spain except for small quantities refined at Khafji on the coast.

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Table 5.—Kuwait-Saudi Arabia Neutral Zone: Exports of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968 •
Crude petroleum [1]	128,595	124,931	130,612	138,137	149,000
Petroleum refinery products: [2]					
Distillate fuel oil	2,877	5,163	2,815	3,141	NA
Residual fuel oil			4,056	3,249	NA
Other [3]	320	629	626	1,421	NA
Total	3,197	5,792	7,497	7,811	8,000

• Estimate. NA Not available
[1] Includes some petroleum refinery products mixed with the crude oil before exporting.
[2] Excludes some petroleum refinery products mixed with the crude oil before exporting.
[3] Mostly naphtha.

COMMODITY REVIEW

Mineral Fuels and Related Materials.—*Petroleum.*—All of the AOC production is high-sulfur crude from the Burgan producing zone (Upper Cretaceous System) of the Khafji oilfield. Because of the improvement of pollution standards and pressure by marketers in Japan, AOC has spent most of the year developing the Ratawi producing zone (Lower Cretaceous System) of Khafji and the new Hout oilfield. The latter field is to begin oil production in 1969. AOC's plans envisage low-sulfur crude oil production to average about 50,000 barrels per day in 1969.

South Umm Gudair field, discovered just south of the Kuwait boundary in 1967, came into production in April 1968. Output from the field is expected to reach 75,000 barrels per day from 16 wells. The oil flows to manifolds at Wafra via a 22-mile, 16-inch pipeline with a capacity of 95,000 barrels per day. Capacity of the low-sulfur Ratawi producing zone at Wafra is being expanded to 80,000 barrels daily.

Although no exploration wells were completed in 1968, exploratory activities revealed a prospective structure in the southeastern part of the Neutral Zone which was scheduled for drilling in 1969. In addition, seismic data covering the areas around the islands of Umm Al Maradim, Qaru, and Kubbar were studied.

Wafra field continued as the major onshore producer. During 1968, 14 wells were equipped with pumps and at yearend only 12 percent of the 362 producing wells at Wafra were flowing. Electrical submersible pumps were installed at several of the deep Ratawi zone wells with encouraging results. Five experimental workovers and recompletions performed in the Wafra Burgan reservoir during 1968 resulted in improved production and provided promise for a successful workover program when justified by improved market demand.

SAUDI ARABIA

The petroleum and natural gas industry of Saudi Arabia continued to record significant gains in 1968 and revenues from this industry are gradually transforming the country into an advancing economy. Other minerals play an insignificant role in the economy.

Although crude oil production increased 9 percent during 1968, Saudi Arabia (excluding Neutral Zone operations) fell just behind Iran to become the Middle East's second largest producer and the fifth largest in the world. Annual crude oil production, which for the first time topped the 1-billion-barrel mark in 1968, had an estimated value of $1.3 billion based on estimated realized prices.

Government revenues from crude oil production and refining (including Neutral Zone operations) was approximately $1 billion in 1968 compared with $334 million in 1960. Petroleum industry revenues account for one-third of the gross national product (GNP), 88 percent of ordinary government income, and more than 90 percent of foreign exchange receipts. Since

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the stabilization program of 1958, the Government has devoted increasing attention and financial resources to the promotion of economic development, especially infrastructure.[4]

In its attempts to diversify the country's economy, the Government has encouraged, *inter alia,* the development of other mineral industries and petroleum-related activities by Saudi Arabian capital. In 1962, the wholly owned government corporation, General Petroleum and Mineral Organization (Petromin) was established to stimulate and direct this development. Wholly or partly owned Petromin projects, either completed or underway, include two refineries, a fertilizer plant, a sulfur project, a steel rolling mill, several petroleum and mineral exploration ventures, and petroleum distribution and marketing facilities. Furthermore, companies have been established for geophysical exploration, drilling, marine construction, and tanker operations.

Since 1966 Petromin, in association with a French company, has been exploring for minerals in the Western Province with success in finding phosphate, sulfur, and copper deposits.[5] At yearend 1968, the Ministry of Petroleum and Mineral Resources was considering the award of a minerals exploration contract to National Minerals Company, which is a new joint company formed by Petromin, a company from Dallas, Tex., and private Saudi investors. It is believed that the concession area considered is about 100 miles north of Nejran in a district with known pyrite deposits.

In January 1968, a royal decree endorsed the protocol agreement for the establishment of the Organization of Arab Petroleum Exporting Countries (AOPEC) in which Kuwait and Libya are the only other members. This organization, in addition to conforming to the policies of the Organization of Petroleum Exporting Countries (OPEC), aims to create closer economic ties between the major market for Arab oil, European countries, and the Arab exporting countries. As a means for implementing the long-term policy objectives of AOPEC, Mr. Yamani, the Minister of Petroleum and Mineral Resources, expressed several times during 1968 the need for creating a partnership between the Arabian American Oil Company and Petromin such that Saudi capital will share not only in production and refining operations, but also in all downstream operations, including foreign marketing.

During the year the Governments of Saudi Arabia and Iran concluded an agreement demarcating territorial claims in the Persian Gulf. The accord settled a long-term dispute between the countries and cleared the way for future petroleum exploration and development, as well as for discussions on other Persian Gulf issues. Legislation affirming ownership of seabed and subsoil resources beneath the waters of the Red Sea entitled "Regulations for the Ownership of Red Sea Resources" was ratified by a Saudi Arabian royal decree on October 1, 1968. According to an explanatory note, the Saudis maintain that under existing international principles, they have a just claim to resources which are found in the continental shelf adjacent to Saudi Arabia. The note also includes an invitation to the Sudanese to discuss the matter, presumably to share the resources and establish boundary demarcations.

PRODUCTION

Noteworthy mineral output developments in 1968 were the 24-percent increase in cement, 9-percent rise in crude petroleum, and 21-percent advance in refining. During November 1968, cumulated crude oil production (excluding Saudi Arabia's Neutral Zone share) reached 10 billion barrels, making Saudi Arabia the fifth nation to reach this level. Furthermore, during that month daily crude oil production for the first time averaged more than 3 million barrels daily. Because data on marble and salt production have not been reported by the Government since 1963, these data have been removed from the production table.

TRADE

Crude oil and petroleum refining products are essentially the only mineral commodities exported by Saudi Arabia. Based on estimated realized prices for crude oil and posted prices for petroleum refinery products, exports were valued at $1.5 billion in 1968. Major mineral imports were semimanufactured steel products, gold, and cement. The total value of imports in the Hejira calendar year 1385 (May 1, 1965 through April 20, 1966) were equivalent to $50 million.

[4] World Business. No. 11, April 1968, p. 28.
[5] Engineering and Mining Journal. V. 169, No. 6, June 1968, pp. 122, 326.

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Table 6.—Saudi Arabia: Production of mineral commodities

Commodity		1964	1965	1966	1967	1968
NONMETALS						
Cement	metric tons	239,817	264,000	250,242	323,239	• 400,000
Gypsum	do	10,560	22,599	23,686	27,752	• 30,000
Lime	do	6,897	8,320	8,988	6,500	• 7,000
MINERAL FUELS						
Crude petroleum	thousand 42-gallon barrels	628,095	739,078	873,349	948,110	1,035,773
Petroleum refinery products:						
Aviation gasoline	do	373	244	327	125	145
Motor gasoline	do	13,537	17,052	17,650	20,404	24,446
Jet fuel	do	6,159	8,345	10,276	9,438	13,177
Kerosine	do	3,197	2,190	1,921	2,885	3,081
Distillate fuel oil	do	13,689	12,737	16,029	16,221	18,738
Residual fuel oil	do	56,376	63,811	60,334	64,655	76,376
Liquefied petroleum gas	do	4,031	5,062	5,679	6,683	10,635
Other	do	5,814	281	654	842	822
Total	do	103,176	109,722	112,870	121,253	147,420
Refinery fuel and loss	do	4,525	5,839	5,260	5,577	5,755

• Estimate.

Table 7.—Saudi Arabia: Exports of crude petroleum and petroleum refinery products [1]

(Thousand 42-gallon barrels)

Commodity	1966	1967	1968
Crude petroleum	760,127	819,823	891,675
Petroleum refinery products:			
Aviation gasoline	75	-------	-------
Motor gasoline	14,695	16,441	21,179
Jet fuel	10,389	9,162	13,298
Kerosine	605	1,389	1,430
Distillate fuel oil	12,691	12,070	15,322
Residual fuel oil	38,843	33,046	44,500
Liquefied petroleum gas	5,605	6,406	9,905
Total	82,908	78,514	105,634

[1] Statistics are for Aramco only. Data on country of destination are not available. The continental distribution of total crude petroleum and petroleum refinery products exported in 1968 was as follows, in percent: Europe 49.4 percent; Asia 35.8 percent; South America 4.0 percent; North America 3.7 percent; Africa 3.6 percent; Australia 3.5 percent.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Saudi Arabia's first steel rolling mill was completed at Jidda in late 1967 and operated satisfactorily during 1968; however, production data are not available. The plant, which has a maximum annual capacity of 45,000 tons, utilized imported billets and can produce a variety of sizes and shapes of reinforcing wire and rods, plates, and angles. Plans are to eventually produce steel billets from imported ingot and in the distant future to create an integrated iron and steel plant. This final stage will involve mining and smelting domestic iron ore. Three principal iron ore deposits have been identified and studied. The first, Wadi Sawawin, near the Gulf of Aqaba, is 20 kilometers from the coast and covers an area 26 kilometers long and 2 kilometers wide. It is a hematite deposit containing 40 percent iron. The second, Wadi Fatimah, located 40 kilometers south of Jidda, has

Table 8.—Saudi Arabia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965 [1]	1966 [2]
METALS		
Gold [3] thousand troy ounces	353	1,215
Iron and steel:		
Scrap	-------	2,593
Semimanufactures:		
Plates	1,893	998
Bars and rods	67,475	70,613
Sheets and angles	19,108	15,979
Tubes, pipes and fittings	19,042	34,446
Other	1,972	2,244
NONMETALS		
Cement	339,680	491,770
Gypsum	-------	5,796
Marble	-------	5,795
MINERAL FUELS AND RELATED MATERIALS		
Lubricants	17,293	17,426
Paraffin and vaseline	2,125	2,682

[1] The Hejira Calendar year (1384) ending May 1, 1965.
[2] The Hejira Calendar year (1385) ending April 20, 1966.
[3] Including platinum plated gold.

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50 million tons of hematite reserves averaging 45 percent iron. The remaining source of iron ore is the Jebel Idsas magnetite deposit in central Saudi Arabia which is reported at 6 million tons containing 69 percent iron.[6]

Nonmetals.—*Fertilizer Materials.*—Two fertilizer plants are under construction in eastern Saudi Arabia, one at Dammam and the other at Abqaiq. The former is being built by Saudi Arabian Fertilizer Co. (SAFCO) under the overall supervisory guidance and responsibility of Occidental Petroleum Corp. The latter has agreed to purchase, for 17 years, the entire production (except that assigned for local consumption) and to market abroad at current world prices, receiving a 5-percent commission. The $50 million complex will include single train units to produce 600 tons per day of ammonia and 1,100 tons daily of urea using natural gas feedstock supplied by Petromin from Aramco. In addition, the plant will produce 35 tons of sulfur daily.

The Abqaiq project will have an initial capacity to produce 150,000 tons of sulfur per year from an estimated 500 million cubic feet per day of natural gas. Jefferson Lake Sulfur Co., a subsidiary of Occidental Petroleum Corp., holds a one-third interest and Petromin the remaining two-thirds. Petromin will make available part of its share to private Saudi investors.

Mineral Fuels and Related Materials.—*Petroleum and Natural Gas.*—Although Aramco is the only oil and gas producing company in Saudi Arabia, Petromin and other foreign companies are now engaged in a variety of petroleum activities including exploration, refining, and marketing. At the end of 1968, Aramco held two-thirds of the 158,100 square miles under concession and Petromin in association with other companies held the remainder.

Aramco.—Aramco continued its high level of development activity by attaining new operational records, finding new fields, and expanding facilities, including major refinery expansion.

In March 1968, the company relinquished another 20,000 square miles of concession area, reducing the total to 105,000 square miles from an original 672,840 square miles. As scheduled, subsequent relinquishments will reduce the total concession area to 20,000 square miles by 1993.

Seismic crews operated in the Rub al Khali, east of Riyadh, and along the shore north of Dhahran. Aramco began the year with five crews; however, two were terminated during the year. A marine seismic crew ran a reflection survey in the Zuluf-Marjan area of the Persian Gulf.

Drilling activity reached a peak in 1968 with 77 wells drilled—39 for oil, 24 for water injection, and two as observation wells. Most of the development wells were in the Abqaiq and Ghawar fields. Although 12 wells were abandoned or suspended during the year, new fields were found at Shaybah in the eastern Rub al Khali and at Juraybi'at southwest of the Kuwait-Saudi Arabia Neutral Zone. In addition, a new producing zone was found in the Berri field. As a result, gross estimated proved petroleum reserves increased by 8.4 billion barrels. The 84.4 billion barrels of reserves at yearend 1968 ranked Saudi Arabia first in the world with 18 percent of the total. Natural gas reserves were set at 39.8 trillion cubic feet.

Construction of new facilities continued at a rapid rate during the year. Included are three gas-oil separators at Khurais field and the 86-mile Khurais-Ain Dar pipeline. Together they enable the field to produce 30,000 barrels per day.

In addition, two stabilizers were completed at Abqaiq, a gas-oil separator 25 miles offshore in the Safaniya field was nearing completion, and work was started on a third gas compressor at the Abqaiq natural gas processing plant. The latter will bring total liquefied petroleum gas production capacity of the plant to 51,000 barrels per day.

A new crude oil distillation unit was completed at the Ras Tanura refinery in May 1968 to increase overall refinery efficiency and raise the throughput capacity by 175,000 barrels per day. Although the daily capacity of this refinery is officially set at 430,000 barrels, daily runs of 500,000 barrels are believed feasible.

Construction continued on the deepwater sea island terminal at Ras Tanura. During the year a fifth berth was completed and the sixth berth was scheduled for completion in early 1969. The terminal, which is a 0.8 mile long pier 2 miles offshore,

[6] Progress Report 1968. General Petroleum and Mineral Organization.

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will be able to accommodate five 200,000-deadweight-ton tankers and one 310,000-deadweight-ton tanker. It has a pumping capacity of 7 million barrels daily.

The record 1968 crude oil output of 2,829,982 barrels daily was from 12 fields, of which Ghawar (54 percent), Abqaiq (19 percent), and Safaniya (14 percent) were the largest producers.

The trend which began in Saudi Arabia in 1966 toward producing the relatively lightweight, low-sulfur crude oils became quite obvious in 1968 as production from six fields (including Safaniya) which yield heavyweight, high-sulfur crudes declined sharply. Increased production from Ghawar field more than offset the decline in these fields.

Bunkers loaded by Aramco on vessels engaged in international trade totaled 32,197,000 barrels in 1968, down slightly from that in 1967. Residual fuel oil accounted for 98 percent of the total.

Petromin.—During 1968, Petromin completed its purchase of all domestic petroleum marketing facilities from Aramco, a program which began in 1964. A second Petromin refinery, to be located at Riyadh, is in the advanced stages of planning. This 15,000-barrel-per-day plant will be supplied with crude oil from the nearby Khurais field and will cost an estimated $22 million. Petromin will provide the necessary capital and will make shares available to the private domestic sector.

Petromin has proposed to build a refinery in Turkey using Rumanian refinery equipment in an attempt to integrate abroad. The refinery to be built on the Black Sea coast of Turkey will be supplied under a long-term contract using Saudi Arabian royalty crude. Rumanians are to construct the plant. A similar proposal which envisioned a refinery in Lebanon failed to materialize.

A step into international marketing was finalized with Rumania in April 1968 in which 9 million tons (approximately 65 million barrels) of crude will be supplied by Petromin from mid-1968 through 1971 in return for Rumanian goods worth about $100 millon. The crude is part of the 20 million tons (approximately 150 million barrels) which Aramco agreed to make available at Ras Tanura for sale in Eastern Europe.

Petromin-Sarco.—The 12,000-barrel-per-day Jidda refinery, ownel 75 percent by Petromin and 25 percent by Saudi Arabian Refining Co. (private Saudi firm), successfully completed preliminary tests and came on stream during mid-1968. Units include a gasoline treating unit (Merox), desulfurization units, and an asphalt plant. Plans are to expand the refinery's capacity to 30,000 barrels daily. Crude oil supplies are shipped from Ras Tanura.

Auxirap-Tenneco.—On May 8, 1968, the Tenneco Oil Co., a U.S. firm, obtained a one-third interest in the 26,000-square-kilometer Red Sea concession held by Société Auxilaire de la Régie Autonome du Pétroles (Auxirap). The concession, awarded in February 1966, consists of three blocks offshore and onshore along the Red Sea coast—two in the far north and one near the border with Yemen. During the year, seismic exploration activity was increased and at yearend a well, second to the unsuccessful well drilled in 1967, was planned. If oil is found, Petromin has the right to purchase up to 40 percent of the venture.

ENI-Phillips.—During April 1968, Phillips Petroleum Co., a U.S. firm, acquired a 50-percent interest in a concession obtained by a subsidiary of Ente Nazionale Idrocarburi (ENI), the Italian state petroleum agency. Concomitant with the entry of Phillips, the concession area was increased by 9,107 square kilometers and now totals 86,469 square kilometers. Exploration activity during the year was limited to seismic studies. If oil is found, Petromin may elect to purchase up to a 40-percent interest.

Sinclair-Natomas-Pakistan.—Sinclair Oil Co., operator of a 25,000-square-kilometer concession located along the Red Sea coast, performed seismic surveys throughout much of the area. Natomas Co. is a U.S. firm with interests in shipping and minerals exploration, as well as petroleum. Pakistan interests are held by the Government through the Oil and Gas Development Corp. If oil is found, Petromin may rightfully purchase up to 50 percent of the holding.

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The Mineral Industry of Liberia

By Walter C. Woodmansee [1]

Liberia's iron ore mining sector in 1968 contributed about 55 percent to the gross national product (GNP) estimated at $250 million,[2] according to the Department of Planning and Economic Affairs. The entire mining sector, including gold and diamond as well as iron ore, contributed $175.2 million, or 70 percent, to the GNP. Value of output of these three commodities was as follows: Iron ore, $136.4 million, based on average prices of $6.70 per ton of ore and $11.00 per ton of pellets; diamond, $38.7 million (gem diamond $36.8 million), purchased by official buyers, probably originating largely outside Liberia; and gold, $109,000, based on central bank purchases at $34 per ounce. The processing sector of the mineral industry was expected to make a significant contribution to the economy with the opening in 1968 of two major plants—a 125,000-ton-per-year cement plant and a 10,000-barrel-per-day petroleum refinery.

The four major iron ore-mining companies operated at full capacity during the year, and most were undergoing expansion. Africa's first pellet plant, with a 2-million-ton annual capacity, went onstream in January, and another of similar size was planned. Increased iron ore output and quality improvement through pelletizing were expected to increase export value by about $32 million during 1969. A barite deposit was under exploration, and a kyanite deposit attracted interest. Other mineral deposits may be discovered during geological survey work underway, sponsored by the U.S. Agency for International Development (AID) and the United Nations Development Program.

Dredging was underway at the port of Monrovia, financed by a $3.6 million World Bank loan, to enable the loading of 90,000-deadweight-ton bulk ore carriers, double the former capacity. Further port and rail expansion may become necessary if other high-grade iron ore deposits in the Nimba Range, extending into the Republic of Guinea, are developed.

Foreign investment was declining in Liberia, although opportunities remained attractive with assurance of a continuing "open door" policy, the U.S. dollar as authorized Liberian currency, a free flow of investment capital in and out of the country, expanding electric power development, and a stable government.

PRODUCTION

The mining sector remained limited to output of iron ore, gold, and diamond, in addition to unreported activity in pit and quarry products such as clay, sand, and gravel for local construction use. Cement production from imported clinker started in January, but the quantity and value were not reported. Based on rated annual capacity, output was estimated at 100,000 tons in 1968. The new petroleum refinery was brought onstream in stages, and small quantities of crude oil were processed in test runs.

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[1] Physical scientist, Division of International Activities.

[2] U.S. Embassy, Monrovia. Economic Trends Report, 1969. State Dept. Airgram A-67, July 3, 1969, p. 2.

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Table 1.—Liberia: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Gold [2]—troy ounces	1,824	1,701	4,351	5,111	3,216
Iron ore—thousand metric tons	12,999	15,959	16,859	18,224	19,571
NONMETALS					
Cement—do	--------	--------	--------	--------	• 100
Diamond: [3]					
Gem—thousand carats	298	277	343	362	537
Industrial—do	273	263	212	181	213
Total—do	571	540	555	543	750

• Estimate.
[1] In addition to commodities listed, construction materials such as common clay, sand and gravel were produced, but quantitative data are not available. The Liberia Refining Co. petroleum refinery began production in late 1968, but output data are not available.
[2] Purchases by Bank of Monrovia.
[3] Exports for fiscal year ending August 31.

Iron ore production increased by 7.4 percent during 1968. Output by company and type of product was (in thousand metric tons) as follows:

Bong Mining Co.: Concentrates	4,218
Liberian American-Swedish Mining Co.:	
Run-of-mine	1,406
Lump ore	2,877
Fines	3,587
Pellets	1,227
Subtotal	9,098
Liberian Mining Co.:	
Lump ore	941
Fines	841
Concentrates	997
Subtotal	2,779
National Iron Ore Co., Ltd.:	
Lump ore	1,287
Fines	2,190
Subtotal	3,477
Total	19,571

TRADE

According to statistics provided by the Department of Planning and Economic Affairs, Liberia's mineral commodity exports of $120.6 million, including $115.1 million for iron ore, was 76 percent of total commodity exports during 1967, the latest year for which complete data were available. Mineral commodity imports of $18.6 million was nearly 15 percent of total imports of $125.2 million.

Grängesberg of Sweden, exclusive sales agent for Liberian American-Swedish Mining Co. (LAMCO), has long-term contracts for delivery of iron ore and concentrates to Belgium, France, West Germany, Italy, Japan, and other countries. Starting in April 1968, 10 million tons of washed fines were delivered to a group of Japanese steelmakers under a 7-year contract.

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Table 2.—Liberia: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
Exports		
METALS		
Iron and steel:		
Ore and concentrate thousand metric tons	16,272	17,252
Metal, scrap	1,756	10,213
Nonferrous metals, scrap	214	182
NONMETALS		
Diamond:		
Gem carats	342,731	NA
Industrial, including bort carats	212,226	NA
Total do	554,957	NA
Imports		
METALS		
Aluminum, metal, including alloys, all forms	98	393
Copper, metal, including alloys, all forms	13	14
Iron and steel, all forms	12,913	25,934
NONMETALS		
Cement and building materials	41,741	47,451
Fertilizers, manufactured, all types	3,281	4,736
Salt	1,590	2,359
Nonmetallic minerals, crude, n.e.s	885	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum, refinery products:		
Gasoline, motor and aviation thousand 42-gallon barrels	247	251
Kerosine and jet fuel do	165	177
Distillate fuel oil do	299	454
Residual fuel oil do	207	267
Lubricants do	13	326
Total do	931	1,475

NA Not available.

Source: Statistical Office of the United Nations, Supplement to the World Trade Annual: Trade of the Industrialized Nations with Eastern Europe and The Developing Nations, Volume III, Africa, 1967, pp. 498–508.

Table 3.—Liberia: Value of principal mineral commodity foreign trade

(Thousand dollars)

Commodity	1966	1967
Exports:		
Metals: Iron ore	106,330	115,146
Nonmetals: Diamond, gem and industrial	3,107	5,356
Mineral fuels: Petroleum, refinery products	147	24
Miscellaneous	13	31
Total	109,597	120,557
Imports:		
Metals:		
Aluminum	133	177
Copper	34	164
Iron and steel	3,491	5,252
Lead	17	7
Nickel	3	19
Zinc	165	25
Metallic ores and scrap	6	10
Nonmetals:		
Cement, lime, and building materials	2,448	2,443
Clay construction materials	75	223
Fertilizer materials:		
Crude	75	66
Manufactured	227	374
Inorganic chemicals, metallic oxides	1,127	1,025
Stone, sand and gravel	18	103
Minerals, crude, n.e.s	152	192
Mineral manufactures	109	310
Mineral fuels:		
Gas, manufactured	151	146
Petroleum:		
Crude	44	18
Refinery products	10,072	8,000
Mineral tar and crude chemicals from coal, oil and gas distillation	107	48
Miscellaneous	1	21
Total	18,455	18,623

Source: Department of Planning and Economic Affairs. External Trade of Liberia, 1965–67. Monrovia, Liberia.

COMMODITY REVIEW

METALS

Iron Ore.—*Bong Mining Co.*—This company, owned by the German Liberian Mining Co. (DELIMCO), produced 23 percent more concentrates in 1968 than in 1967 and shipped 4.1 million tons, compared with 3.3 million tons in 1967. Shipments were to Rohstoffhandel G.m.b.H., West Germany (2.8 million tons) and Italsider S.p.A., Italy (1.3 million tons). Mine expansion continued.

In September an agreement was reached with the Government, permitting construction of a $40 million, 2-million-ton-per-year pelletizing plant. A further $5 million was

Table 4.—Liberia: Iron ore exports

(Thousand metric tons)

Destination	1967	1968
Belgium-Luxembourg	1,116	1,238
Canada	45	366
France	1,059	883
Germany, West	6,322	6,115
Greece	80	48
Italy	2,440	2,645
Japan	235	1,139
Netherlands	1,139	1,878
Sweden	1	79
United Kingdom	1,705	1,846
United States	3,110	2,608
Other	------	73
Total	17,252	18,918

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allotted for eight new lines for low-grade ore in the concentrating plant. Concentrator expansion was near completion at yearend. A construction contract for the pellet plant was to be awarded early in 1969.[3]

Exploration continued in the Putu Mountains in the southeastern part of the country.

Liberian American-Swedish Mining Co. (LAMCO).—LAMCO output of ore, fines, and pellets increased 10 percent in 1968. According to the 1968 annual report of Liberia Iron Ore Ltd., LAMCO's operator at the Nimba mine, operating data were as follows:

	1967	1968
Production--million metric tons--	8.2	9.1
Shipments----------do----	7.8	8.7
Shipments scheduled------do----	9.3	10.6
Sales---------value, thousands--	$34,294	$43,631
Net profit----------do----	$6,721	$7,816
Ore reserves:		
Proved--million metric tons--	217	207
Probable----------do----	33	33

In February the first shipments were made from the new $54 million integrated washing and pelletizing plant at Buchanan. This plant was among the first to produce pellets from shipping-grade ore rather than from concentrates. Designed annual pellet capacity is 2,156,000 tons, and washing capacity is 10 million tons. The pellet plant is the Dravo-Lurgi type and was built by the Dravo Corp. (United States).[4]

Liberian Iron and Steel Corp. (LISCO).—Exploration by an international consortium was underway at the Wologisi deposit, 230 kilometers northeast of Monrovia, where reserves reportedly are the largest in the country. The international survey team comprised Marubeni-Iida Co. (Japan), E. J. Longyear Co. (United States), McKay and Schnellmann Ltd. (United Kingdom) who are handling the exploration, Reymond Concrete Tile Co. (United States) doing the drilling, and Motor-Columbus A.G. (Switzerland), general consultants. An objective is the proving of a minimum of 300 million tons of high-grade ore.

Liberia Mining Co. (LMC).—LMC, owned by Prospect Corp. (59.2 percent), a subsidiary of Republic Steel Corp., and other private interests (40.8 percent), showed a decline in output during 1968. The decrease was minor, output being 2.9 million tons in 1967 and 2.8 million tons in 1968.

National Iron Ore Co. (NIOC).—This company, starting its seventh year of production at the Mano River deposit, near the Sierra Leone border, produced 3.7 million tons in 1967 and 3.5 million tons in 1968.

NONMETALS

Barite.—Dresser Industries, Inc., Houston, Texas, was granted a 30-year concession to the Gibi deposit, discovered during an AID project conducted by the U.S. Geological Survey and the Liberia Geological Survey. Of six separate deposits, two are considered of commercial interest.[5] Exploration was underway at yearend. According to terms of the agreement, 20 percent of the stock in the operating company would be made available to Liberian citizens on a 40 percent cash payment, the remainder to be paid from a guaranteed 6-percent dividend. Also, three Liberians will be appointed to a nine-man Board of Directors.[6]

Cement.—In January, Liberian Cement Co. (CEMENCO) began production at its $2.5 million, 125,000-ton-per-year plant. Clinker is imported from Norway for processing at the plant. In February a new law was passed prohibiting cement imports except by CEMENCO.

MINERAL FUELS

Petroleum.—Preliminary offshore surveys were undertaken by several companies, prior to requests by the Government for bids for offshore leases, expected in 1969. In January, Lockwood, Kessler and Bartlett, Inc. (United States) completed an aerial magnetic-radiometric survey, onshore and offshore to the edge of the Continental Shelf, testing thickness of the offshore sedimentary section. According to the local newspaper, The Liberian Age, of September 13, 1968, Chevron Oil Exploration Co. completed an offshore seismic survey.

Owing to construction delays, the $15 million, 10,000-barrel-per-day refinery at Gardnersville, 9 kilometers from the Monrovia port, was only in partial production late in the year and was officially dedicated

[3] U.S. Embassy, Monrovia. State Dept. Airgram A-344, Sept. 27, 1968, 2 pp.
[4] American Metal Market. V. 75, No. 72, Apr. 15, 1968, p. 8.
[5] Industrial Minerals (London). No. 10, July 1968, p. 28.
[6] U.S. Embassy, Monrovia. State Dept. Airgram A-311, Aug. 1, 1968, 2 pp.

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on December 30. Liberia Refining Co. was given a 25-year refining concession. Products are gasoline, kerosine, jet fuel, diesel oil, gas oil, and bitumens. The company employs 230 Liberians and 35 Americans. Crude oil is to be imported from Venezuela and the Persian Gulf. Because of a price dispute, Saudi Arabia crude oil was substituted for Iran crude oil.[7]

International Fuel Corp., having the same ownership as the refinery, was formed for bunkering services. The roles of existing distributors (Texaco, Mobil, Shell, British Petroleum, and Agip) in local markets was undetermined at yearend.

[7] Petroleum Intelligence Weekly. Oct. 14, 1968, p. 3.

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The Mineral Industry of Libya

By Walter C. Woodmansee [1]

During 1968, Libya's crude petroleum production capacity was the fastest growing in the world, and expansion continued at the end of the year. On a basis of output in barrels per day, Libya ranked sixth in the world at yearend, passing Kuwait, and preceded only by the United States, U.S.S.R., Venezuela, Iran, and Saudi Arabia. Petroleum exploration and development continued at a fast pace, and discoveries were announced by several companies. Late in the year, 32 drill rigs were active—12 wildcatting and 20 in field development work. Forty-one companies were working concession areas. At midyear there were 790 producing wells. Reserves were estimated at 30 billion barrels of crude oil and 20,000 billion cubic feet of natural gas.[2]

According to the Ministry of Planning and Development, the petroleum sector contributed more than US$1 billion to a Gross National Product (GNP) of about US$1.5 billion in 1967, and more than $2 billion to a GNP of $2.3 billion in 1968.[3]

National Libyan Petroleum Corp.—Lipetco—was established by royal decree in late 1967 and became an operating company in April 1968.[4] Through Lipetco, the Libyan Government took definite steps to participate actively in every phase of petroleum operations in Libya. Lipetco represents the Libyan Government and acts as its operating agent. It appeared that the old system of competitive bidding for acreage by both governmental and private companies would be replaced by direct negotiations with Lipetco. In July Lipetco approved resolutions of the 16th Conference of Oil Producing and Exporting Countries (OPEC), which provided for direct development by member countries and renegotiation of concessions to allow national participation. In December, it adopted OPEC-recommended petroleum conservation regulations. Lipetco planned to hold more than 50 percent ownership in any new company or venture. Its plans included exploitation of uncommitted acreage by participation deals, formation of a comprehensive training program for Libyans with foreign technical assistance, a study of local marketing and distribution, establishment of a Libyan tanker fleet, a project for utilizing and processing associated natural gas presently flared, and a feasibility study for a pipeline from numerous small fields in the West.

Another significant activity in the petroleum sector during 1968 was the conclusion of a Libyan-French oil pact involving large areas of uncommitted and relinquished acreage. Concession areas, both onshore and offshore, totaled 29,850 square kilometers. The French companies involved, Société Nationale des Pétroles d'Aquitaine (SNPA) and Enterprise de Recherches et d'Activités Pétrolieres (ERAP), were committed to spending $22.5 million in a 10-year period (including $14 million in the first 5 years) in the onshore blocks and at least $3.3 million offshore. If oil is discovered, Lipetco is entitled to a 25 percent share of output up to 200,000 barrels per day in a 25-year agreement; if output should exceed 200,000 barrels daily Lipetco's share increases to a maximum of 50 percent for 550,000 barrels per day. A bonus arrangement was involved in the agreement—$1 million paid by the French at the final signing of the pact, $3 million after the first commercial discovery, and $9 million if production reaches 300,000 barrels per day.[5]

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[1] Physical scientist, Division of International Activities.

[2] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 103.

[3] Where necessary, values have been converted from Libyan pounds (£L) to U.S. dollars at the rate of £1 1=US$2.80.

[4] The decree was published in Arab Oil Review. V. 5, Nos. 3–4, March–April 1968, pp. 11–15.

[5] Oil and Gas International. V. 8, No. 6, June 1968, p. 186.

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Development and production costs are to be split between the French and the Libyans, based on proportionate shares in the undertaking. The income tax rate is 50 percent, and a sliding-scale royalty schedule starts at 12.5 percent, increasing to 15 percent if output reaches 500,000 barrels per day. All payments are at posted prices. In the offshore area, the French were granted a direct concession without Libyan participation.[6]

In October an agreement was reached between operating oil companies and the Libyan Government on an accelerated tax and royalty payment schedule. Under the new agreement between the Libyan Petroleum Ministry and Esso Standard Libya, which paved the way for settlements with other companies, income taxes, formerly paid annually, are payable quarterly within 30 days of the end of the quarter. This change is to be phased in gradually over a 3-year period. Royalty payments will continue on a quarterly basis but within 30 days rather than the former 60 days.[7] It has been estimated that during the 1968–72 catchup period, the new system will cost the companies more than $100 million[8] in lost interest earnings, assuming a 7-percent annual rate. However, there are some benefits to the operating companies—certain direct taxes are to be treated as deductions, the system of a 5-year rollover advance to the Government is to be discontinued, and existing 1965 contested tax returns are to be cleared.

In March 1968 Occidental of Libya, Inc., drilling at Kufrah Oasis in southeast Libya, tapped a huge reservoir of good-quality water. This fresh water resource was considered important enough to perhaps lead to major population shifts to the area.[9]

PRODUCTION

Output of crude oil increased nearly 50 percent during 1968, as the established producers made significant increases and one newcomer—Occidental—commenced large-scale production. Occidental made its first shipment in February, and by mid-year the production rate was in excess of 500,000 barrels per day; the company's average for the year was 382,000 barrels per day. Increases of other major producers were as follows, in barrels per day: Esso Standard Libya, Inc., 140,000; British Petroleum Exploration Company-Nelson Bunker Hunt, 140,000; American Overseas Petroleum, Ltd. (Amoseas), 110,000; and Oasis Oil Company of Libya, Inc., 55,000.

Crude oil output was 2.2 million barrels per day in January, 2.7 million barrels in midyear, and approached 3 million barrels at yearend. The average for the year was 2.6 million barrels compared with 1.7 million barrels in 1967. The year 1969 was expected to show another substantial gain to more than 3 million barrels per day.

[6] Oil and Gas Journal. V. 66, No. 27, July 1, 1968, pp. 70–71.
[7] Petroleum Legislation Report. No. 52, November–December 1968, pp. 18–19.
[8] Petroleum Intelligence Weekly. Oct. 21, 1968, pp. 3–4.
[9] Business Week. Feb. 22, 1969, pp. 168, 170.

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Table 1.—Libya: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968
NONMETALS [1]					
Cement •----thousand metric tons--	----------	----------	100	100	200
Gypsum----metric tons--	400	1,865	2,500	•r 10,000	14,400
Salt----thousand metric tons--	12	12	• 12	• 16	• 16
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, gross production [2] million cubic feet--	• 231,200	303,433	361,247	• 415,000	620,000
Petroleum:					
Crude----thousand 42-gallon barrels--	315,660	445,374	552,712	636,504	948,519
Refinery products:					
Motor gasoline----do----	----------	----------	----------	• 370	494
Naphtha----do----	----------	----------	----------	• 90	122
Kerosine----do----	----------	----------	----------	• 160	215
Distillate fuel oil----do----	----------	----------	----------	• 500	666
Residual fuel oil----do----	----------	----------	----------	• 750	972
Total----do----	----------	----------	----------	• 1,870	2,469

• Estimate. r Revised.
[1] In addition to commodities listed, Libya also produces construction materials such as sand, gravel, crushed stone, brick, and tile, but output data are not available.
[2] Mostly flared; in 1968, an estimated 1,000 million cubic feet was used as fuel in oilfield operations and 1,860 million cubic feet was used for gas lift.

According to official Government statistics, the December rate of production, by company, was as follows:

Company	Barrels per day
Esso Standard Libya	696,500
Oasis	693,800
Occidental	513,700
Amoseas	339,800
British Petroleum-Hunt	282,200
Mobil-Gelsenberg	243,800
Phillips	7,000
Pan American	800
Total	2,777,600

Production data on several mineral commodities are not available. The 9,000-barrel-per-day petroleum refinery at Marsa el-Brega, which went on stream in 1967, was in operation during 1968. Refinery output was valued at $4.7 million [10] in 1967 ($3.7 million of which was in local sales, $0.9 million in exports, and the remainder in stock increases) and $6.2 million in 1968.

TRADE

Crude oil exports increased nearly 15 percent in 1967, the latest year for which complete data are available, and were valued at nearly $1.2 billion. This commodity accounted for essentially all income from the export market. West Germany continued as major customer, taking 23.5 percent of total crude oil exports compared with 34.4 percent in 1966. This decrease was due to a 13-week embargo on oil shipments to certain countries after the Arab-Israeli war in June 1967. United States and United Kingdom shares of oil exports from Libya also were affected by this embargo. The Suez Canal closure and the low-sulfur quality of Libyan crude oil were important factors in opening new markets. Oil shipments were made for the first time to Greece, Ireland, and Uruguay and were renewed, after a lapse of more than 2 years, to Sweden and Ghana.

Principal mineral and metal imports were as follows:

	Value (million dollars)	
	1966	1967
Iron and steel (mainly tubes, pipes and fittings)	$24.9	$36.8
Petroleum refinery products	15.6	15.9
Cement	8.8	10.1
Nonferrous metals	3.8	2.9

[10] Kingdom of Libya, Ministry of Planning and Development. Report of the Annual Survey of Petroleum Mining Industry. Tripoli, Libya, 1968, p. 26.

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The relationship between mineral-commodity trade and total trade is given in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	786	790
1966	984	987
1967	1,166	1,169
Imports:		
1965	56	320
1966	65	405
1967	75	476

Table 2.—Libya: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
Metals:		
Iron and steel, scrap	8,395	4,069
Nonferrous metals, scrap	1,056	608
Mineral fuels and related materials:		
Petroleum, crude—thousand 42-gallon barrels	547,351	627,138
REEXPORTS		
Metals:		
Copper and alloys, unwrought	19	------
Iron and steel:		
Scrap	------	98
Semimanufactures	222	8
Nonmetals:		
Cement	------	10
Mineral fuels and related materials: Petroleum, refinery products:		
Lubricating oil, grease	48	------
Gasoline and white spirit—thousand 42-gallon barrels	------	1,365
IMPORTS		
Metals:		
Aluminum and alloys, all forms	1,793	2,213
Copper and alloys, all forms	1,361	944
Iron and steel:		
Scrap	824	94
Steel, primary forms	1,645	4,917
Semimanufactures:		
Pipes, tubes, and fittings	64,654	118,672
Other	55,060	92,458
Lead, including alloys, all forms	271	407
Silver:		
Ore and concentrate	------	64
Metal, unworked or partly worked—troy ounces	------	514
Tin, including alloys, all forms—long tons	62	67
Zinc, including alloys, all forms	452	468
Nonmetals:		
Abrasives:		
Natural	10,183	7,923
Grinding and polishing wheels and stones	71	105
Asbestos:		
Crude	27	------
Asbestos cement building materials	11,745	16,432
Cement—thousand tons	620	701
Clays and clay products:		
Crude clays, n.e.s—do	32	14
Products, nonrefractory	126,595	86,527
Fertilizer materials:		
Crude	355	430
Manufactured	21,960	21,550
Gypsum and plasters	1,007	316
Lime	44,013	51,379
Mica, worked	208	14
Pigments, mineral	151	510
Salt	104	252
Stone, sand and gravel:		
Dimension stone	13,612	14,728
Gravel and crushed rock	11,001	14,004
Limestone	2,657	61

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Table 2.—Libya: Foreign trade in mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967
IMPORTS—Continued			
Nonmetals—Continued			
Sulfur		26	1
Talc and steatite		55	40
Other nonmetals, n.e.s.		304	319
Mineral fuels and related materials:			
Asphalt, natural		14,479	30,078
Coal and coal products			2,250
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels	942	1,482
Kerosine and jet fuel	do.	606	230
Distillate fuel oil	do.	1,513	1,750
Residual fuel oil	do.	401	279
Lubricants	do.	71	96
Asphalt, wax, and bitumen	do.	47	171
Liquefied petroleum gas	do.	63	84
Total	do.	3,643	4,092

COMMODITY REVIEW

NONMETALS

Cement.—Libya's first cement plant, that of the National Cement Co. at Homs, east of Tripoli, was in production at an annual rate of 110,000 tons. The Benghazi plant of Libyan Cement Co. was completed during the year. Its rated annual capacity is 200,000 tons.

Fertilizer Materials.—*Ammonia.*—Occidental of Libya, Inc., in conjunction with the Libyan Government, planned an $84 million, 1,200-ton-per-day ammonia plant at Zuetina, near Occidental's petroleum terminal.

Sulfur.—In June Esso Standard Libya, Inc., awarded a construction contract to Ralph M. Parsons Co., Ltd. for a sulfur plant at Marsa el-Brega with a designed annual capacity of 45,000 tons of sulfur, derived from natural gas. The unit is to be added to the recently constructed gas liquefaction plant. Completion of the sulfur unit was expected in late 1969.

MINERAL FUELS

Natural Gas.—In December, trial runs were made at the Esso Standard Libya liquefied natural gas plant at the Marsa el-Brega terminal. The gas is disassociated from crude oil at the Zelten field and transported to the terminal via a pipeline parallel to the crude oil line. Esso signed a contract with SNAM Progretti, S.p.A., which built the main gas line, for a 88-kilometer, 20-inch spur line from the Raguba field to the main line.[11] Esso has two supply contracts—one for 110 million cubic feet per day to Spain and the other for 235 million cubic feet per day to Italy.

After purification, natural gas is refrigerated to liquid at minus 260°F and atmospheric pressure. Storage is in two 300,000-barrel, double-walled tanks at Marsa el-Brega.[12] The first of four ocean-going refrigerator tankers, each of 250,000-barrel capacity (equivalent to 750 million cubic feet of gas) in four insulated aluminum tanks, was delivered.

Bechtel Corp. conducted a feasibility study on extracting gas at Occidental's Idris and Augila fields, where 1,410 cubic feet of gas is associated with each barrel of crude oil produced. Late in the year, Occidental announced plans for a $60 million, 20-inch, natural gasoline and liquefied petroleum gas pipeline to Zuetina, parallel to the crude line from the Idris fields. A new plant at the field will produce 68,000 barrels per day, mainly propane, butane, and naphtha, from 650 million cubic feet of associated gas produced daily. Remain-

[11] Gas World. V. 168, No. 4395, Nov. 9, 1968, p. 442.
[12] Bechtel Briefs. V. 23, No. 8, August 1968, pp. 10–11.

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Table 3.—Libya: Crude oil production by company and field

(Thousand barrels)

Company and Field	1967	1968
American Overseas Petroleum, Ltd. (Amoseas)		
Beda	11,854	9,114
Dor	459	1,997
Kotla	4,088	4,207
Nafoora	30,655	73,944
Subtotal	47,056	89,262
British Petroleum Co., Ltd.-Nelson Bunker Hunt		
Sarir	61,509	111,287
Esso Sirte Libya, Inc.		
Raguba	39,111	42,899
Esso Standard Libya, Inc.		
Arshed	683	1,209
Jebel	14,600	15,355
Lahib	1,789	5,152
Meghail	326	368
Ralah	271	376
Zelten	162,327	202,164
Subtotal	180,996	224,624
Mobil Oil Libya, Ltd.-Gelsenberg Benzin, A.G.		
Amal	55,925	71,798
Hofra	9,868	8,174
Ora	8,733	6,793
Subtotal	74,526	86,765
Oasis Oil Co. of Libya, Inc.		
Dahra	36,287	32,027
Gialo	110,778	130,738
Samah	31,621	33,184
Waha	49,486	53,131
Zaggut	1,772	2,023
Subtotal	229,944	251,103
Occidental of Libya, Inc.		
Augila D	-------	63
Idris A	-------	123,181
Idris D	-------	16,215
Subtotal	-------	139,459
Phillips Petroleum Co. of Libya		
Umm Farud	1,744	2,725
Pan American Libyan Oil Co.		
Khuff	1,618	395
Total	636,504	948,519

Table 4.—Libya: Crude oil exports, by major country

(Thousand barrels)

Destination	1966	1967
Belgium	20,772	33,284
Canada	5,083	5,896
Denmark	7,740	13,162
France	64,216	80,615
Germany, West	188,311	148,570
Greece	-------	1,414
Italy	65,692	129,234
Netherlands	53,373	58,127
Netherlands Antilles	487	2,803
Norway	3,876	6,089
Spain	21,056	27,891
Sweden	-------	1,899
Switzerland	4,792	6,281
Trinidad and Tobago	1,991	7,197
Turkey	3,563	3,726
United Kingdom	75,970	75,737
United States	27,437	18,268
Yugoslavia	1,315	4,324
Other	1,677	2,021
Total	547,351	627,188

ing dry gas is to be reinjected into the oil wells.[13]

Petroleum.—*Amoseas.*—Amoseas planned an expansion of 80,000 barrels per day in the pipeline from the Nafoora field to the Amal-Ras Lanuf pipeline, which is jointly owned with Mobil-Gelsenberg, raising total capacity to 400,000 barrels per day. The company had five drill rigs operating in Concession 51.

Aquitaine Libya.—In January a consortium comprising Hispanica de Petroles d'Aquitaine (Hispanoil) (42 percent), Société Nationale des Pétroles d'Aquitaine (SNPA) (28 percent), Murphy Oil Co. (16 percent), and Société Auxiliare de l'Enterprise de Recherches et d'Activités Pétrolieres (Auxirap) (14 percent) struck oil in Concession 105.

The discovery well, the first wildcat in the concession, tested at 1,358 barrels per day at 9,515 feet. A second hole was abandoned as noncommercial, but a third tested at 5,000 barrels per day.[14]

British Petroleum-Nelson Bunker Hunt.—British Petroleum (BP) was drilling in Concession 80, immediately north of the joint company's large Sarir field. In this BP-operated field, development drilling, at 2-kilometer centers, and tie-in of new wells continued and was essentially completed. Desalting facilities were increased with installation of new electrical equipment, and new gathering lines were laid to segregate salty "wet" production from clean "dry" production. A water injection scheme was initiated in certain sections of the field where well pressure was diminishing, and electric down-well submersible pumps were installed in a number of wells. In addition, the company planned to install a new buoy tanker berth at the Tobruk terminal. Sarir field pipeline capacity was under expansion to more than 400,000 barrels per day.

[13] Journal of Commerce. Jan. 28, 1969, p. 10.
[14] Oil and Gas Journal. V. 66, No. 24, June 10, 1968, p. 76.

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Unofficial estimates suggest that in-place reserves may be as high as 12 billion barrels in the main pool and 3 billion barrels in adjacent pools.[15]

Esso Standard Libya, Inc.—Esso continued as leading producer in 1967, exporting crude oil at an average rate of 592,000 barrels per day.[16] Pipeline capacity was expanded to 780,000 barrels per day by addition of five pumping stations. The output rate at yearend was 740,000 barrels per day with 550,000 barrels from the Zelten field.

At midyear Esso reportedly suspended the search in far western Libya for sufficient oil to justify a pipeline to the coast. To date, a number of small discoveries have been made.

Mobil-Gelsenberg.—Six drill rigs were in operation—one wildcatting and five in development drilling at the Amal field.

In April a discovery was made in Concession 126, about 140 kilometers south of the Amal field. The well tested at 1,050 barrels per day of 45° API gravity oil.[17] Stepout drilling resulted in another successful well, testing at 3,000 barrels per day of high gravity, low sulfur oil at a depth of 11,000 feet.[18] A second wildcat well in Concession 126 was dry, and a third wildcat was in progress late in the year. Mobil also reported a discovery in Concession 12, west of the Amal field.

The new Rakb field, south of the Amal field, went on stream in July with four wells producing 15,000 barrels per day of 36° API, low-sulfur oil from two pay zones at depths of 2,700 to 9,500 feet. The new field was linked to the main pipeline to the Ras Lanuf terminal by a 22-inch spur.

The Amal-Ras Lanuf pipeline was undergoing expansion to 650,000-barrel-per-day capacity, with completion expected by mid-1969. Chicago Bridge and Iron Co. was constructing two additional 200,000-barrel tanks at the Amal field and five 500,000-barrel tanks at Ras Lanuf. The new storage capacity at the terminal will be 6.5 million barrels. Loading capacity was under expansion to 660,000 barrels per day.

The Amal field produced at a rate of 185,000 barrels per day from about 85 wells, 65 percent of which were flowing and the remainder gas-lift. Mobil-Gelsenberg also moved about 25,000 barrels per day from 70 wells in the Hofra field, and 20,000 barrels per day from 28 wells in the Ora field. In Concession 13, north of Ora, six of seven holes in the new Dor Marada field were successful. Two wells at depths of about 3,000 feet each produced less than 1,000 barrels daily, and four wells at 9,500 feet averaged 2,300 barrels per day.[19]

Oasis Oil Company of Libya.—Late in the year, Oasis had two drill rigs engaged in wildcatting and two engaged in development drilling at its Defa field. A discovery was made in Concession 32, 32 kilometers northwest of its Dahra field, in the western part of the Sirte Basin. The well tested at 2,380 barrels per day of 42.2° gravity oil at a depth of 3,700 feet in Paleocene limestone.[20] It was the first success of six holes drilled in the area. Two stepout wells were planned. Drilling continued in Concession 71, a large tract south of the company's Samah and Defa fields.

A $12 million pipeline expansion was underway to increase capacity from 700,000 to 900,000 barrels per day. The added capacity was needed for anticipated increased output from the Defa field. The project involves construction of a new 24-inch, 270-kilometer line parallel to the existing 30-inch line to the Es Sider terminal. The new line was expected to be operational in early 1969. United States Steel had the contract for pipe supply. Construction contractor is Williams Brothers, Tulsa, Okla.[21]

Occidental of Libya, Inc.—In midyear Occidental had nine drill rigs doing development drilling in the Idris A and D fields, Concession 103. Production reached a rate of 300,000 barrels per day in March and 600,000 barrels per day in November. There were 17 productive wells in the Idris A field and 6 productive wells (and five near completion) in the Idris D field. Average well output was 26,000 barrels per day.[22] Occidental planned an output rate of 1 million barrels per day by yearend, but a drop in field pressure necessi-

[15] Oil and Gas International. V. 8, No. 4, April 1968, pp. 88–90.
[16] Oil and Gas International. V. 8, No. 2, February 1968, p. 122.
[17] Petroleum Times. V. 72, No. 1848, June 7, 1968, p. 834.
[18] Oil and Gas Journal. V. 66, No. 28, July 8, 1968, p. 42.
[19] Oil and Gas Journal. V. 66, No. 40, Sept. 30, 1968, pp. 37–38.
[20] Oil and Gas Journal. V. 66, No. 47, Nov. 18, 1968, p. 103.
[21] Pipe Line Industry. V. 29, No. 6, December 1968, p. 78.
[22] World Petroleum. V. 40, No. 2, February 1969, pp. 14–15.

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tated limiting daily output to 600,000 barrels. Pressure maintenance programs were started at both fields. Production from Idris C field was planned for early 1969.

Idris crude oil is high quality, having a 43° to 45° API gravity, low sulfur, low wax, and low pour point. The discovery well (No. A–1) tested 43,000 barrels per day of 43.5° API gravity oil from Paleocene reefal limestone at depth of 9,417 feet; 292 meters of porous oil zone was logged.[23]

The Augila field in Concession 102 was given lower priority in development because it appeared to be of lower productivity and produced an oil of less desirable quality. Early in the year, nine successful wells had been drilled. They tested an aggregate 97,500 barrels per day. The crude is 34.5° to 36.5° API gravity, 0.1 to 0.2 percent sulfur, and 19 to 20 percent wax. A pour point of 70° to 80°F may cause flow problems without special handling facilities.

The initial phase of Occidental's pipeline and Zuetina terminal project was completed in February following a period of only 8 months after the first discovery in the Idris A field. The main 40-inch, 219-kilometer line, largest in Libya, connects the Idris A field to Zuetina port. A 24-inch, 64-kilometer feeding line was completed from the Augila field to the main line. Ultimate capacity will be more than 1 million barrels per day. Bechtel International, Inc., Petroleum and Chemical Division, had overall responsibility for engineering and supply procurement.

Construction continued on the Zuetina storage and loading facilities. The first stage included five storage tanks with total capacity of 2.55 million barrels, two conventional 7-point tanker moorings, 5 kilometers offshore, each handling up to 100,000-deadweight ton vessels, and three 42-inch submarine lines, each of 50,000-barrel-per-hour loading capacity. Final storage capacity at the terminal will be 6.9 million barrels in twelve 560,000-barrel tanks and one 135,000-barrel tank. Three additional 48-inch submarine lines to three new mooring points farther offshore, capable of handling vessels up to 250,000 deadweight tons, were planned.

Occidental signed a contract with Signal Oil and Gas Co. to supply Signal's refinery with crude oil at a rate of 150,000 barrels per day with annual increases of 15,000 barrels per day for 10 years. A 10-year, $1 billion contract for crude oil sales also was concluded with Societa Industriale Catanese, S.p.A., a Milan-based subsidiary of the Montecatini-Edison group. The delivery rate is 80,000 barrels per day, later to be escalated to 200,000 barrels per day.[24] The company also completed an agreement with Union Rheinische Braunkohlen Kraftstoff, A.G., West Germany, to supply technical services in Concession 108, adjacent to Occidental holdings in Concession 103. Occidental has the right to purchase one-half of any oil discovered and produced from the German property at near cost for 20 years. As of October, Occidental had drilled two holes, both of which were dry, a third was at 9,851 feet, and a fourth was planned.[25]

Standard Oil Co. of California-Texas Oil Co. (Caltex).—In November Caltex secured a 75 percent interest in Concessions 119 and 120 held by Clark Oil and Refining Co. In granting approval of the transaction, the Government of Libya received improved concession terms and increased work obligations on the part of Caltex. The companies agreed to a $1 million signature bonus and a further $1 million if production attains 10,000 barrels per day from the concessions.[26]

Other Companies.—Pan American was drilling in Concession 95, west of the Amal field. Sirtica Shell Co. was drilling in Concession 114, near the coast at Marsa el-Brega. Agip, Inc., reportedly struck oil in Concession 100, on the east border of the Sirte Basin, near the Sarir field. Elwerath Oil Co. Libya-Wintershall Libya, Inc., made a discovery in Concession 97 in November. American Mining and Exploration Co. cancelled its agreement for drilling in Concession 118. Libyan Atlantic Richfield, Inc. Phillips had drilled 16 holes in four offshore concessions along the Gulf of Sirte since 1963 and suspended operations in order to evaluate data. Circle Oil Co., holding Concessions 121, 122, and 123, began drilling in August. Bosco Middle East Petroleum Co., with Concessions 134 and 135, started drilling in September.

[23] World Petroleum. V. 39, No. 4, April 1968, pp. 40–42.
[24] Page 19 of work cited in footnote 7.
[25] Petroleum Times. V. 72, No. 1857, Oct. 11, 1968, p. 1453.
[26] Page 17 of work cited in footnote 7.

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The Mineral Industry of Malaysia

By A. F. Grube[1]

Malaysia's economy registered moderate gains during 1968. The projected increase in gross national product at current market prices was estimated at 4 to 5 percent. Tin, the production of which was valued at $231 million, retained its position as the country's most valuable mineral. The country's tin miners produced 75,069 long tons, the highest level of production registered since the Japanese occupation. Late in the year the Malaysia Federal Government established a special fund with an initial allocation of $162,338 as part of a continuing program to encourage greater participation by Malays in the production of tin in the Malay Reservations. The form of assistance to be granted has not yet been determined. Tin mining is currently typified by Chinese-owned gravel pump mines and European-owned dredges.

In late 1968 the Malaysian National Lands Council appointed a committee to establish uniform terms for offshore mining. The Lands Council has already approved a proposal requiring companies to secure permits before conducting comprehensive geological surveys prior to actual exploration.

During 1968 negotiations were held between the States and Federal Government of Malaysia and foreign investors regarding exploration rights for various minerals, including petroleum, tin, copper, and mercury.

In April 1968 the Minister of Lands and Mines announced the consolidation for increased efficiency of the Research Division of the Department of Mines with the Geological Survey Department into a single unit to be called the Bureau of Mineral Development.

PRODUCTION

Lower tin prices and reduced iron ore production in 1968 continued to have an adverse effect on the value of Malaysia's mineral production. Although production of tin-in-concentrates increased over the 1967 level, the value decreased from $235 million in 1967 to $231 million in 1968. The value of iron ore dropped from $42 million in 1967 to $40 million in 1968. The production value of bauxite also declined by nearly $500,000 as compared with that in 1967. Bauxite mines in Sarawak have been closed down for the past 3 years, and the only mines in operation during the year were two in West Malaysia. The increased 1968 production of gold, monazite, and copper was not sufficient to compensate for the decreased value of tin, iron, and bauxite. Gold production was valued at $156,000, monazite at $282,000, and copper at $90,000.

Increased production of crude oil, nearly 5 times that of 1967, was the most favorable mineral industry development during the year. The increase was made possible by the commencement of production from the newly discovered offshore field at West Lutong in Sarawak in July 1968. Despite this increased production, Malaysia is still a relatively minor producer of crude oil. The value of crude oil production in 1968 was set at $2.9 million, as contrasted to a value of $600,000 in 1967.

For the past 3 years West Malaysia has accounted for virtually the nation's entire mineral output other than crude oil and gold. All of the country's crude oil production, however, comes from Sarawak which also produces about 65 percent of

[1] Industry economist, Division of International Activities.

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the country's gold. Sabah's only mineral production consists of relatively insignificant amounts of construction materials such as stone, gravel, cement, and clay bricks.

The three State governments have granted mineral exploration rights to numerous domestic and foreign-owned mining companies over the past several years. High hopes are held for the discovery of minerals, particularly tin and crude oil, offshore from Malaysia.

Table 1.—Malaysia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum: Bauxite:					
Malaya, thousand tons	471	857	956	900	799
Sarawak, do.	161	137	--	--	--
Total, do.	632	994	956	900	799
Antimony, mine output, metal content (Sarawak)	78	55	59	31	e20
Columbite-tantalite concentrate, columbium-tantalum ratio 4:7, 70 to 80 percent pentoxides	57	47	68	r88	52
Copper, mine output, metal content e	271	438	191	1254	1319
Gold:					
Malaya (crude), troy ounces	7,296	r4,051	2,959	r1,290	1,454
Sarawak (fine), do.	3,115	2,602	2,611	2,521	2,718
Iron ore, 60 to 64 percent iron, thousand tons	6,569	6,983	5,855	5,436	5,167
Manganese ore, 30 to 40 percent manganese	--	1,591	58,788	85,105	45,121
Rare earths:					
Monazite (exports)	308	705	880	962	2,138
Xenotime (yttrium minerals; exports)	e10	e10	155	260	70
Tin:					
Mine (contained in 75 to 76 percent concentrate), long tons	60,004	63,670	68,886	72,121	75,069
Metal including secondary, do.	71,351	72,469	71,049	76,328	88,318
Titanium, ilmenite concentrate, exports	131,337	123,517	118,264	90,806	125,825
Tungsten, ore and concentrate, tungsten content	4	5	2	15	65
Zircon, concentrate (exports)	147	571	786	472	1,126
NONMETALS					
Cement, thousand tons	466	739	e850	e835	e900
Kaolin, do.	1	2	2	2	2
Lime (Sarawak)	--	190	132	160	e150
MINERAL FUELS AND RELATED MATERIALS					
Petroleum:					
Crude oil (Sarawak), thousand 42-gallon barrels	352	351	346	328	1,521
Refinery products: r					
Gasoline, do.	6,846	6,517	6,974	7,106	p8,649
Kerosine and jet fuel, do.	2,265	2,158	2,626	1,855	p7,431
Distillate fuel oil, do.	10,259	8,832	5,664	3,272	p6,445
Residual fuel oil, do.	18,953	15,925	20,371	e20,000	p18,832
Other, do.	917	819	450	4,585	p1,672
Refinery fuel and loss, do.	e1,000	e1,000	e1,100	2,483	p2,271
Total, do.	35,240	34,751	37,185	39,301	40,300

e Estimate. r Revised. p Preliminary.
1 Exports.

TRADE [2]

Malaysia's overall 1967 trade, in terms of value, registered a minor decrease from the previous year's. The country was able, however, to maintain its favorable trade balance. Exports of mineral commodities, although of lower value in 1967, still accounted for nearly one-third the country's total trade. Lower tin prices and significantly reduced exports of iron ore caused this decline. Although the quantity of tin metal exported from West Malaysia in 1967 was greater than in 1966, the value declined from $253 million in 1966 to $241.5 million in 1967. Similarly, iron ore exports from West Malaysia went from $44.2 million in value in 1966 to $39.6 million in 1967. Crude oil and petroleum

[2] Excludes trade between the three political subdivisions comprising the country.

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products exported from Sarawak, valued at $79 million, constituted the only other important mineral commodity export. This latter figure includes reexport of crude oil received from Brunei in the amount of $34 million.

West Malaysia's major mineral commodity import was iron and steel valued at $47 million, followed by metalliferous ores and metal scrap, with a value of $13.5 million. Sarawak's only significant import was crude oil and petroleum products with a value of $81 million. The Crude oil portion, all from Brunei, was valued at $76 million. Sabah's major import consisted of petroleum products valued at $7 million.

The value of total trade, mineral commodity trade, and the net trade balance for Malaysia for 1966–67 was as follows:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total commodity trade	
Exports and reexports: [1]			
1966:			
Sabah	r0.5	r114.1	0.4
Sarawak	72.5	r143.1	50.7
West Malaysia	r337.0	r991.5	34.0
Total	410.0	r1,248.7	32.8
1967:			
Sabah	0.4	130.5	0.3
Sarawak	79.6	155.0	51.4
West Malaysia	321.8	923.0	34.9
Total	401.8	1,208.5	33.2
Imports: [1]			
1966:			
Sabah	r13.8	r100.6	13.7
Sarawak	88.0	r156.5	53.0
West Malaysia	r156.8	r849.9	18.4
Total	r253.6	r1,107.0	22.9
1967:			
Sabah	11.7	93.5	12.5
Sarawak	87.2	157.2	55.5
West Malaysia	155.6	828.8	18.8
Total	254.5	1,079.5	23.6
Net trade balance: [1]			
1966:			
Sabah	r −13.3	r13.5	XX
Sarawak	−10.5	r −18.4	XX
West Malaysia	r180.2	r141.6	XX
Total	r156.4	r141.7	XX
1967:			
Sabah	−11.3	37.0	XX
Sarawak	−7.6	−2.2	XX
West Malaysia	166.2	94.2	XX
Total	147.3	129.0	XX

r Revised. XX Not applicable.
[1] Excludes trade between political subdivisions.

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Table 2.—Malaysia: Exports and reexports[1] of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
WEST MALAYSIA			
METALS			
Aluminum, bauxite	1,023,000	875,978	Japan 617,477; Canada 150,584.
Copper, all forms	r 825	1,192	Singapore 1,037.
Iron and steel:			
Iron ore—thousand tons	5,772	5,330	Japan 5,265.
Pig iron	416	299	Mainly to Thailand.
Iron and steel scrap	33,284	37,391	Singapore 28,331; Japan 6,661.
Semimanufactures	r 8,849	10,607	Singapore 3,138; Thailand 2,490.
Manganese ore	69,319	60,281	All to Japan.
Other nonferrous metal ore, n.e.s.	r 1,030	752	Japan 362; United Kingdom 286; United States 109.
Other nonferrous metal scrap	r 5,194	5,580	Singapore 2,729; Japan 2,846.
Tin:			
Ore—long tons	1,254	1,176	All to Singapore.
Tin slag and hard head—do	2,873	24,897	West Germany 12,500; United States 9,000.
Tin and tin alloys, unwrought—do	71,468	73,573	United States 32,379; Japan 19,102.
Titanium concentrate (ilmenite)	118,254	90,806	Japan 90,754.
Uranium and thorium ore	1,038	1,222	Japan 429; United States 308; United Kingdom 301.
NONMETALS			
Cement	r 153,096	265,949	Singapore 166,188; Thailand 50,671; Indonesia 28,964.
Fertilizers, manufactured	7,698	3,563	Thailand 3,264.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil [2] (reexport) thousand 42-gallon barrels	r 1,967	2,371	Singapore 1,674; Australia 697.
Refinery products:			
Gasoline—do	r 839	695	Singapore 433; Indonesia 91; South Vietnam, 86.
Kerosine and jet fuel—do	r 561	604	South Vietnam 164; Thailand 8, Singapore 70.
Distillate fuel oil—do	r 776	830	Singapore 425; Thailand 405.
Residual fuel oil—do	r 2,013	1,599	Singapore 812; South Vietnam, 770.
Other—do	r 329	86	Mainly to Singapore.
Total—do	r 4,518	3,814	
Ships' bunkers—do	290	371	NA.
Aircraft bunkers—do	135	134	NA.
SARAWAK			
METALS			
Iron and steel scrap	644	1,239	Singapore 1,149.
Nonferrous ores	105	122	Japan 61; West Germany 61.
Nonferrous metal scrap	200	171	Mainly to Hong Kong.
Silver, unworked—troy ounces	---	1,167	All to Singapore.
NONMETALS			
Baked clay building materials	203	394	Mainly to Brunei.
Stone, all types	1,502	3,548	Do.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude oil—thousand 42-gallon barrels	14,048	15,858	Australia 6,801; Burma 1,164.
Unfinished oils—do	590	1,565	Singapore 1,215; Philippines 147.
Refinery products:			
Aviation gasoline—do	56	89	All to Singapore.
Motor gasoline—do	3,201	741	Singapore 536; New Zealand 193.
Kerosine—do	1,108	1,639	Mainly to Brunei.
Jet fuel—do	1,162	3,998	Mainly to Singapore.
Distillate fuel oil—do	1,054	1,050	Singapore 1,027.
Residual fuel oil—do	8,538	8,625	Singapore 8,527.
Total—do	15,119	16,142	
Bunkers:			
Aircraft—do	1	1	NA.
Ships—do	7	28	NA.

See footnotes at end of table.

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Table 2.—Malaysia: Exports and reexports [1] of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
SABAH			
METALS			
Iron and steel:			
Iron and steel scrap	724	717	Mainly to Singapore.
Semimanufactures	r 52	61	Brunei 58.
NONMETALS			
Cement and clinker	r 169	9	Mainly to Indonesia.
MINERAL FUELS AND RELATED MATERIALS			
Refinery products thousand 42-gallon barrels	r 15	24	Mainly to Brunei.
Petroleum bunkers:			
Ships' bunkers ---do---	68	77	NA.
Aviation bunkers ---do---	54	56	NA.
Total ---do---	122	133	

NA Not available. r Revised.
[1] Excludes trade between political subdivisions.
[2] Primarily unfinished oils.

Source: Official Government trade returns from Sabah, Sarawak, and West Malaysia.

Table 3.—Malaysia: Imports [1] of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
WEST MALAYSIA			
METALS			
Aluminum, all forms	4,641	4,529	Canada 1,544; United Kingdom 1,104; Japan 857.
Copper and alloys, all forms	2,471	2,199	Zambia 752; Japan 701; United Kingdom 503.
Iron and steel:			
Iron and steel scrap	5,168	5,844	Hong Kong 2,032; West Germany 1,698; Singapore 1,348.
Pig iron	r 8,346	5,910	Mainland China 4,073; U.S.S.R. 1,259.
Semimanufactures:			
Bars, rods, and shapes	r 118,808	158,969	India 35,930; mainland China 34,704; Japan 32,334.
Plates and sheets	107,957	124,708	Japan 83,016; United Kingdom 12,774; Australia 7,409.
Other	r 92,470	76,480	Japan 27,386; mainland China 16,167; Singapore 10,610.
Lead, all forms	636	468	Singapore 212; United Kingdom 113.
Manganese ore	1,408	1,648	Mainly from Singapore.
Tin:			
Ore ---long tons---	3,242	6,769	Thailand 1,272; Australia 1,218; Singapore 1,104.
Metal and alloys, all forms ---do---	278	254	Japan 104; United Kingdom 56; Singapore 32.
Zinc:			
Ore and concentrate	847	2,287	Mainly from Singapore.
All other forms	1,620	2,475	Singapore 1,394; Japan 568; Australia 374.
NONMETALS			
Asbestos, crude	8,982	11,097	Canada 5,835.
Cement and clinker	5,318	5,929	United Kingdom 2,626; Singapore 1,024; Denmark 898.

See footnotes at end of table.

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Table 3.—Malaysia: Imports[1] of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
WEST MALAYSIA—Continued			
NONMETALS—Continued			
Fertilizer materials:			
Crude:			
Phosphate rock	113,639	101,911	Christmas Island 77,351; United States 12,193.
Manufactured:			
Nitrogenous	155,320	122,615	East Germany 44,888; Japan 33,084; United Kingdom 30,480.
Phosphatic	6,581	6,111	West Germany 2,181; Netherlands 1,538; United States 1,141.
Potassic	45,668	56,323	Israel 21,033; Canada 16,776; West Germany 15,488.
Salt	72,829	84,613	Thailand 54,216; mainland China 8,088.
Sulfur	5,145	3,182	Singapore 2,076; France 818.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all types	23,098	11,126	North Vietnam 3,999; South Vietnam 3,679; Australia 3,193.
Coke	6,173	6,950	Taiwan 2,255; Netherlands 2,092; West Germany 1,911.
Petroleum:			
Crude—thousand 42-gallon barrels	r 16,741	17,729	Saudi Arabia 10,072; Kuwait 7,657.
Refinery products:			
Gasoline and naphthas—do	805	853	Singapore 379; Saudi Arabia 286; Bahrain 178.
Kerosine and jet fuel—do	r 723	733	Singapore 392; Saudi Arabia 220; Bahrain 91.
Distillate fuel oil—do	2,517	2,978	Singapore 1,511; Saudi Arabia 1,140.
Residual fuel oil—do	233	133	Singapore 106; Bahrain 16.
Lubricants—do	171	182	Singapore 102; United States 52.
Other	r 98	139	Singapore 36; United States 43.
Total—do	r 4,547	5,018	
SARAWAK			
METALS			
Aluminum and alloys, all forms	317	183	Belgium-Luxembourg 67; Japan 44; Austria 34.
Copper and alloys, all forms	142	83	United Kingdom 57.
Gold bullion—troy ounces	26,445	17,820	All from the United Kingdom.
Iron and steel, all forms	22,564	20,394	Singapore 4,986; Japan 4,391; mainland China 4,374.
Lead, all forms	49	40	Singapore 27; United Kingdom 7.
Tin, all forms—long tons	146	109	Mainly from Japan.
Zinc, all forms	112	78	Belgium-Luxembourg 53; Japan 11.
NONMETALS			
Asbestos, all forms	4,347	3,357	Singapore 2,144; Italy 892.
Cement and clinker	46,617	23,832	Mainland China 11,018; Singapore 5,939; Taiwan 3,823.
Clays, all forms	1,242	1,096	Japan 863.
Dolomite	--------	128	All from Singapore.
Fertilizers:			
Natural phosphates	2,652	5,727	Christmas Island 5,555.
Manufactured:			
Nitrogenous	5,750	5,801	United Kingdom 5,358.
Potassic	1,082	1,488	France 1,184; West Germany 304.
All others	8,274	8,845	West Germany 7,023; Singapore 1,291.
Gypsum and plasters	12	19	Thailand 12; mainland China 6.
Lime	9	47	Mainland China 43.
Limestone	1,453	1,119	Singapore 1,013.
Sand	563	544	Mainly from Brunei.
Slate, marble, and granite, roughly worked	1,327	40	United Kingdom 35; Singapore 4.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, crude thousand 42-gallon barrels	33,680	36,696	All from Brunei.
Unfinished oils—do	381	397	Do.

See footnotes at end of table.

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Table 3.—Malaysia: Imports[1] of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967	Principal sources, 1967
SARAWAK—Continued				
MINERAL FUELS AND RELATED MATERIALS—Continued				
Refinery products:				
Aviation gasoline	do	27	5	Mainly from Singapore.
Motor gasoline	do	213	147	Singapore 143.
Kerosine	do	38	30	Mainly from Singapore.
Jet fuel	do	164	112	Do.
Distillate fuel oil	do	273	234	Singapore 206.
Residual fuel oil	do	32	17	All from Singapore.
Lubricating oil	do	29	30	Singapore 20; United States 5; United Kingdom 3.
Other	do	10	15	Singapore 11.
Total	do	786	590	
Liquefied petroleum gas	value	$320,845	$301,469	Brunei $289,821.
SABAH				
METALS				
Aluminum, all forms		127	96	Japan 42; Belgium-Luxembourg 28; United Kingdom 11.
Copper, all forms		r 61	31	United Kingdom 12; Japan 7.
Gold bullion	troy ounces	38,932	12,599	All from the United Kingdom.
Iron and steel:				
Ore and scrap		1	1	Mainly from the Philippines.
Pig iron and ferroalloys		2	10	All from the United Kingdom.
Ingots and other primary forms		219	118	Japan 38; West Germany 26; Hong Kong 25.
Semimanufactures		r 14,844	13,733	Japan 4,154; Singapore 3,642; Hong Kong 2,333.
Lead, all forms		r 30	53	Singapore 20; Hong Kong 8; United Kingdom 6.
Tin, all forms	long tons	24	20	Mainly from Singapore.
Zinc, all forms		9	6	Japan 2; Singapore 2.
NONMETALS				
Cement and clinker		r 34,438	26,786	Japan 13,997; mainland China 4,580; Taiwan 3,629.
Phosphate rock		588	563	Singapore 509.
Sulfur		3	6	West Germany 3.
Talc and soapstone		r 83	272	Mainland China 169; Norway 85.
MINERAL FUELS AND RELATED MATERIALS				
Coke		34	29	United Kingdom 15; Hong Kong 6; Japan 3.
Petroleum:				
Refinery products:				
Gasoline	thousand 42-gallon barrels	r 286	170	Mainly from Singapore.
Kerosine	do	r 26	30	Do.
Jet fuel	do	98	116	Do.
Distillate fuel oil	do	r 336	311	Do.
Residual fuel oil	do	r 51	85	Do.
Other	do	35	56	Singapore 42; United States 13.
Total	do	r 832	718	

r Revised.
[1] Excludes trade between political subdivisions.

Source: Official Government trade returns from Sabah, Sarawak, and West Malaysia.

COMMODITY REVIEW

METALS

Bauxite.—All bauxite mined in Malaysia during 1968 continued to come from Telok Ramunia in Johore, West Malaysia. Only two mines were in operation during the year.

Copper.—During 1968 the Japanese Overseas Mineral Resources Development Corporation (OMRDC) started geological

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and geophysical surveys and test borings at Mamut Valley, Sabah, for the location of copper deposits. Encouraged by preliminary findings, the company is planning to invest $1 million for further prospecting in addition to the $500,000 it has already invested. If further exploration yields positive results, a development project would be undertaken by 1973, including the construction of a $51 million ore-dressing plant. A new company would be established for development of the deposit with 49 percent of the shares being offered to Malaysians. The Japanese Overseas Economic Fund holds a 50-percent interest in the OMRDC, with the other 50 percent being held by the following Japanese companies: Nippon Mining Co., Ltd.; Mitsubishi Mining Co., Ltd.; Furukawa Mining Company, Ltd.; Mitsui Mining & Smelting Co., Ltd.; and Dowa Mining Co.

Gold.—As in past years most of Malaysia's gold production came from Sarawak, with the balance being produced as a byproduct of tin mining in West Malaysia. Sarawak produced 2,718 troy ounces, and 1,454 troy ounces was produced by the tin miners.

Iron Ore.—As in past years virtually all of Malaysia's iron ore production was exported to Japan. According to Japanese data, imports from Malaysia accounted for 7.5 percent of all the iron ore imported into Japan during 1968. The Japanese, however, are becoming more exacting as to price and quantity in negotiating new contracts, in view of the greater number of suppliers. The downward trend in production and exports probably will continue, unless new high-grade deposits are discovered. Two large iron mines owned by the Eastern Mining and Metals Company, Ltd.—Dungan in Trengganu and Rompin in Pahang—continued to provide the bulk of Malaysia's output.

Iron and Steel.—In July 1968, the formation of a joint Japanese-Malaysian company, called the Steel Pipe Industry of Malaysia, Ltd., was announced. The company plans to build a steel pipe mill costing about $1.5 million at Butterworth, Penang, West Malaysia. Construction is to commence in May 1969, with production starting at yearend. The plant will be capable of manufacturing annually 13,000 tons of electric, resistance-welded, steel pipe of from ½ inch to 4 inches in diameter. The Japanese partners are the Kawasaki Steel Corporation and C. Itoh and Company, Ltd., and the Malaysian partners are Hong Bee Hardware, Sendirian Berhad, and Kim and Company.

The Malayawata Steel Mill at Prai, West Malaysia, is planning to install a second blast furnace, costing about $3.25 million. This addition will double the plant's capacity from 6,000 tons of pig iron per month to 12,000 tons per month. The plant presently produces rolled steel products amounting to 4,000 to 5,000 tons per month.

On August 19, 1968, the Malaysian Government approved the imposition of an import duty of $22.73 per ton to protect the domestic steel industry and accelerate industrialization. Duties will be levied on certain types of steel products, such as steel round bars, high tensile steel, and related products. Parliament also approved the imposition of an import duty of 25 percent, or $40.58 per ton, on tubes and pipes of iron or steel of less than 6 inches in diameter.

Lead and Zinc.—A subsidiary of Emco, Ltd., announced the discovery of a 250,000-ton lead-zinc deposit in Kelantan, West Malaysia in early 1968. The company is presently continuing drilling to determine the extent of the deposit.

Manganese.—Manganese continued to be produced in greatly reduced quantities during 1968 because of reduced sales to Japan, virtually the only customer. In 1967, 49,505 metric tons of ferruginous manganese ore and concentrate were shipped to Japan, as contrasted to shipments of 40,739 metric tons in 1968.

Mercury.—In September 1968, the Sarawak State Government agreed in principle to allow prospecting for mercury by the Japanese Mining Industry Association in the Upper Bau area of the State. The Association plans to send a prospecting team to Sarawak in the very near future.

Rare-Earth Minerals.—Malaysia is becoming an important supplier of yttrium-bearing concentrates, especially xenotime. Currently, all production is obtained as a byproduct of tin mining.

Because of the anticipated increase in demand for yttrium, one of Malaysia's leading exporters of xenotime, Sharikat Harper Gilfillan Berhad, is studying the possibility of establishing a plant to upgrade yttrium-bearing material to 60 per-

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cent yttrium oxide (Y_2O_3). The company has secured the consulting services of British Rare Earths, Ltd.

Tin.—Malaysia easily maintained its position as the world's foremost tin producer in 1968. Production of tin-in-concentrates totaling 75,069 long tons marked a new post-1941 high. It was also the fourth largest output Malaysia has ever recorded. Production increased during 1968 despite the initiation of export controls in September. Malaysia's export quotas as established by the International Tin Council amounted to 20,255 long tons for the September-December 1968 period, and 17,920 long tons for the January-March 1969 period. At yearend 1968, there were 1,110 mines in active production compared with only 1,072 at yearend 1967. The breakdown of 1,110 mines by mining techniques employed was as follows: Dredges, 65; gravel pumping 994; and other, 51.

A jurisdictional dispute between the State and Federal Governments concerning offshore tin mining halted prospecting by the three foreign companies which received offshore West Malaysia tin mining rights earlier in the year. These companies are the Ocean Mining Company, Conzinc Riotinto Malaysia Ltd., and the N.V. Billiton Maatschappij. Although the States have the authority to grant onshore prospecting licenses, the Federal Government believes that it should be consulted regarding offshore rights. These differences were nearly resolved at yearend, but discussions continue on final terms.

The Pan-Malaysia Mining Company Ltd., formed in 1967 by the All-Malaya Chinese Mining Association, decided to turn to inland mining. The Association had applied for a license to prospect for tin in the seabed off Lumut, but withdrew its interest in offshore mining following the Government's decision to allot offshore mining rights to the three international companies mentioned above.

In July 1968 the Perak State Development Corporation announced that it would concentrate initially on tin mining within the State. The corporation plans to carry out prospecting operations in the Kladang Hills area near Ipoh, where it is believed there are rich deposits of tin ore. The corporation's minister also announced that a rich tin-bearing vein had been reported along the railway from Tanjong Malim to Parit Buntar, which would also be investigated.

A new concept in tin mining proved successful at the Kampar, Perak property of Austral Malay Tin, Ltd. The company installed a U.S.-built dragline excavator, which is used in conjunction with U.S. made Allis-Chalmers front end loaders for removing limestone overburden. In the past, when limestone bedrock was reached, placer operations ceased. Now, once the limestone bedrock is removed, conventional placer mining can be resumed. This method may significantly increase tin reserves of Malaysia and the world as a whole. Another first for Malaysia was the decision of the Malaysian Daijin Sendinian Berhad to use a jet ejector mining dredge on their property at Kroh in north Perak, West Malaysia. This type of dredge, which can reach a depth of 300 feet to recover minerals, is reportedly more economical to build, and operating costs are low. The Berjuntai Tin Dredging Ltd. also announced construction of its seventh dredge at a cost of about $10 million. This dredge is to be designed to process 9 million cubic yards per year and will operate in the Kuala Langat section of the company's property in Selangor, West Malaysia.

Early in 1969 the Perak State assembly passed legislation to prevent illegal offshore mining which has recently been plaguing the State. Fines proved inadequate, and police will now be able to seize boats and equipment used in illegal mining operations.

NONMETALS

Cement.—Two companies with three plants controlled the cement industry of Malaysia during 1968. Associated Pan-Malaysia Cement Ltd. is much the larger; its two plants are located in Ipoh and Rawang (in Selangor). Tasek Cement Ltd. has the third plant, also in Ipoh. The two firms had a combined cement capacity in excess of 1.5 million metric tons annually, considerably more than output. However, they signed a joint $11 million contract in 1968 to sell 750,000 tons of clinker (unground, gypsum free cement) to the East Pakistan Industrial Development Corporation.

Fertilizer.—In August 1968 The Dow Chemical N.V., a subsidiary of the United States Dow Chemical Company, announced

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the formation of a new company in Malaysia to produce agricultural chemicals. The new plant is expected to cost at least $1.3 million and is to commence operations towards the end of 1969. The plant is to be built at either Batu Tiga or Prai, West Malaysia, and will supply the Malaysian and adjacent regional markets with agricultural chemicals.

In early 1968 the Malaysian Government decided to levy a duty of $16 per ton on imported ammonium sulfate, ammonium nitrate, and calcium ammonium nitrate, and $20 per ton on imported compound fertilizers. This action was taken following the petition of the Chemical Company of Malaysia, Ltd., which was unable to compete with the lower priced imports. The new duties mean that imports of the fertilizers indicated are virtually prohibited.

MINERAL FUELS

Coal.—The Nippon Coal Mining Co. Ltd. of Japan has indefinitely postponed development of the Silantek coal deposit in Sarawak. The company felt the coal would not be competitive with coal from Queensland, Australia. Currently, Malaysia does not produce any coal and consumes very little.

Petroleum.—During 1968, the Malaysian Government signed oil exploration agreements with four international oil companies, and were negotiating with three others. The oil companies securing signed contracts were Continental Overseas Oil Company for offshore areas on the east coast of West Malaysia; Esso Exploration of Malaysia, also for areas off the east coast of West Malaysia; Sabah Teiseki Oil Company for areas off Sabah; and Oceanic Exploration and Development Company also for areas offshore Sabah. The three companies negotiating with Malaysia are the Mobil Oil Corporation, Frontier Petroleum Company, and Amoco (Malaysia) Petroleum. These companies have applied for acreage offshore along the west coast of West Malaysia. The companies with signed contracts are currently conducting marine seismic work in their areas. Similarly, the French company, Aquitaine, which signed an agreement with the Malaysian Government in 1966, was also conducting seismic work.

The Sarawak Shell Berhad's oilfields in Sarawak continued as Malaysia's only producing oilfields. In July 1968, the company announced that it had begun to produce from Sarawak's first offshore field at West Lutong in Sarawak. Shell Berhad has rights to the entire Sarawak offshore area at the present time. The company will have to relinquish some of the area over the next 2-year period. Talks are now underway between the Federal Government and Sarawak State Government on the possibility of allowing companies other than Shell to explore for oil in Sarawak both on and offshore.

Malaysia's 1968 consumption of refined petroleum products was estimated at 35 million barrels or only one-half of Singapore's consumption during the same year.

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The Mineral Industry of Mexico

By Burton E. Ashley [1]

Growth, expansion, and plans for expansion were the striking aspects of the Mexican mineral industry during 1968. This was partly a reflection of the expanding Mexican economy which showed gains in nearly all indicators. Salient statistics are shown in the following table:

Table 1.—Mexico: Salient statistics

	1965	1966	1967	1968 p
Gross national product (GNP), current prices---millions--	$19,416	$21,768	$24,112	$26,744
Mineral industry contribution to GNP---do---	e 2.718	e 304.7	361.6	495.0
Index of industrial production---(1963 =100)--	119	132	142	154
Index of mineral industry production---do---	105	109	115	118
Mineral industry labor force e---thousand persons--	130,000	NA	133,000	190,000
Value total commodity exports---millions--	$1,022.4	$1,111.0	$1,192.4	$1,103.8
Value mineral commodity exports---do---	$266.3	$301.0	$253.4	$216.6
Value total commodity imports---do---	$1,492.9	$1,559.6	$1,605.2	$1,745.9
Value mineral commodity imports---do---	$15.8	$71.9	$156.1	$155.7

e Estimate. p Preliminary.

Early in the year, the President of the Mexican Mining Chamber announced that various mining interests planned to spend an estimated $80 million on exploration. Demand for gold and silver encouraged reexamination of old properties in the States of San Luis Potosí and Jalisco. Sulfur companies planned to intensify their sulfur search on the Isthmus of Tehuantepec. As a result of additional fluorspar recovery facilities, production in 1968 gained 18 percent over that of 1967.

A $10 million investment was proposed for a magnesium oxide plant at Laguna del Rey, Coahuila. Expansion and modernization of manganese, aluminum, and salt recovery plants were also reported during the year. Over $800 million was being spent for iron and steel production facilities, and output of between 5½ and 6 million tons was forecast for 1975. Consumption of steel in terms of ingots for 1968 approximated 3.4 million tons, and the added capacity is expected to keep pace with future consumption.

Government policy appears to be set in the direction of hastening the process of Mexicanization, or Mexican majority ownership, of mining firms. One step was the doubling of the tax on copper production. The tax, which is tied to the New York export price, was slightly more than 1 peso (about 8 cents) a kilo, but the new law will double this figure. Cía. Minera de Cananea S.A. de C.V., which is almost wholly owned by The Anaconda Company, is the only large producer which is not Mexicanized. It was reported that the new tax will cost Cananea about $2.5 million in additional payments to the Mexican Government annually. As Cananea is not Mexicanized, it is not eligible for the special tax rebates offered to Mexicanized firms. The mining law of 1961 gave foreign-owned companies 25 years to Mexicanize and offered a 50-percent production and export tax rebate to those which did.

Cía. de Azufre Veracruz S.A., a subsidiary of Gulf Resources and Chemical Corp. and the only non-Mexicanized sulfur producer, was reportedly "abruptly" informed that its 1969 output of sulfur was

[1] Physical scientist, Division of International Activities.

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to be limited to 250,000 metric tons compared with past production of around 340,000 tons annually. Furthermore, the company was to market 150,000 tons of sulfur within Mexico. This action could be interpreted as discriminatory, for no Mexicanized sulfur-producing firms were put on a quota basis. Sale price of sulfur in Mexico was about $22 a ton, whereas sulfur shipped to Tampa, Fla., brought around $41. While Gulf Resources was said to have over 300,000 tons of sulfur available for shipping, it was unclear whether its 1969 export quota of over 400,000 tons would be allowed by the Mexican Government.

It was reported that restrictions on Gulf Resources' activities would be lifted upon completion of a plan for Mexicanization of its subsidiary.[2]

According to later reports, Gulf Resources agreed in principle to sell its Mexican holdings and terminal in Tampa, Fla., to Metalúrgica Mexicana Peñoles S.A. and Crédito Minero y Mercantil S.A. for $24 million. The sale is based on a number of conditions, but agreement was to be closed by August 1, 1969.[3]

The Mexican Government[4] published a very useful volume dealing with 29 metallic minerals produced in Mexico. A chapter is devoted to each mineral which details its physical characteristics, uses, and possible substitutions. In addition, and of greater interest, are the short statements listing geographic locations of chief occurrences within the country, mode of occurrence, production, producers, trade, taxes, and reserves.

Another useful publication[5] lists the names and addresses of producers of 41 minerals, both metallic and nonmetallic. In all, there are 286 firms or individuals listed in the metallic section and 166 in the nonmetallic section.

PRODUCTION

Volume of production of mineral commodities was generally mixed in comparison with 1967 figures. Mercury output gained 20 percent, which may be a reflection of the Mexican Government's more vigorous efforts against smuggling. Manganese will probably regain its former levels as the chief producer was readying a new property for production. Rising production trends in mineral construction materials, cement, and steel reflected the growth of the Mexican economy in general.

[2] Mining Journal (London). V. 272, No. 6963, Jan. 31, 1969, p. 99.
[3] Skillings Mining Review. V. 58, No. 21, May 24, 1969, p. 16.
[4] Departamento de Estudios Económicos (Mexico, D.F.) Consejo de Recursos Naturales no Renovables. Los Recursos Minerales de Mexico—Metalicos. 1969, 114 pp.
[5] Departamento de Estudios Económicos (Mexico, D.F.), Consejo de Recursos Naturales no Renovables. Directorio de Empresas Mineras en México. 1968, 44 pp.

Table 2.—Mexico: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum, metal, primary	17,678	19,088	r 20,286	21,512	22,518
Antimony:					
Mine output, metal content	4,788	4,461	4,416	3,738	3,464
Metal (in mixed bars)	983	985	1,271	986	1,090
Arsenic, white [1]	14,748	13,378	15,705	14,968	13,531
Bismuth, metal (in refined and mixed bars)	r 472	r 484	r 454	504	525
Cadmium:					
Mine output, metal content	3,067	2,778	1,629	1,246	1,194
Metal, refined	158	69	110	168	202
Copper:					
Mine output, metal content	52,072	55,248	56,513	56,012	61,110
Matte, metal content [2]	----------	----------	84	74	79
Precipitate, metal content [2]	95	----------	308	246	80
Metal:					
Blister [2]	15,097	7,645	7,980	7,408	8,224
Refined	35,146	46,368	47,174	47,054	51,48[illegible]

See footnotes at the end of the table.

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Table 2.—Mexico: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS—Continued					
Gold:					
Mine output, metal content troy ounces	209,976	215,796	r 213,609	165,287	176,952
Metal, refined do	194,255	195,637	185,574	NA	172,745
Iron and steel:					
Iron ore, metal content	1,392,467	1,592,737	r 1,480,509	1,617,096	1,921,299
Iron ore, 60 percent Fe equivalent [1]	2,320,778	2,654,560	r 2,467,515	2,695,160	3,202,165
Pig iron	926,263	945,947	r 1,136,571	1,279,298	1,598,910
Sponge iron	202,551	212,668	r 265,574	325,924	373,560
Ferroalloys	42,568	43,436	44,657	54,612	48,266
Steel ingots and castings	2,352,250	2,488,452	r 2,749,976	3,059,533	3,285,050
Steel semimanufactures	1,885,480	2,032,246	r 3,923,535	4,235,001	4,589,625
Lead:					
Mine output, metal content	169,957	166,780	174,245	163,907	174,169
Metal (in refined and mixed bars)	166,703	164,307	172,145	161,470	172,260
Manganese, content of ore	r 64,089	r 58,810	r 31,099	30,799	26,707
Manganese ore, 45 percent Mn equivalent [1]	142,420	130,689	69,109	68,442	59,349
Mercury, metal, primary 76-pound flasks	r 12,561	r 19,203	22,075	14,417	17,195
Molybdenum, mine output, metal content kilograms	89,164	80,926	149,663	145,981	79,880
Nickel, mine output, metal content	29	444	55	28	26
Selenium, mine output, metal content kilograms	3,166	8,227	1,711	2,062	1,095
Silver, mine output, metal content thousand troy ounces	41,716	40,332	41,984	38,273	40,031
Tin:					
Mine output, metal content long tons	1,207	503	789	588	519
Metal, primary	1,145	459	795	607	317
Tungsten, mine output, metal content	5	110	86	188	266
Zinc:					
Mine output, metal content	r 235,603	r 224,876	r 219,180	241,215	240,021
Metal, primary	59,426	62,613	71,585	70,861	80,038
NONMETALS					
Barite	334,044	368,342	r 291,684	223,280	246,539
Cement, hydraulic	4,418,109	4,322,139	4,907,214	r 5,597,208	6,125,788
Clays:					
Bentonite	16,230	17,077	25,607	32,580	40,073
Fuller's earth	4,614	9,172	6,020	18,643	11,281
Kaolin	64,225	r 81,098	r 97,687	78,592	75,715
Refractory	987	382	3,259	98,049	102,037
Diatomite	2,050	895	8,461	7,186	9,944
Feldspar	31,900	47,700	82,700	63,600	80,257
Fertilizer materials:					
Crude (natural): Phosphate rock	33,124	39,473	55,788	54,264	25,913
Manufactured:					
Nitrogenous, gross weight	469,320	r 198,511	443,558	450,200	780,885
Phosphatic, gross weight	164,055	165,530	200,149	231,600	209,478
Mixed, gross weight	176,948	228,766	262,286	251,399	NA
Fluorspar, all grades	642,872	735,381	r 726,397	785,114	926,000
Graphite, all grades	30,337	r 40,414	38,752	40,690	52,964
Gypsum and anhydrite, crude	1,165,054	1,081,745	1,151,071	976,401	1,285,242
Mica, all grades	304	546	396	884	737
Perlite	8,962	8,350	10,095	10,572	9,929
Quartz, quartzite, and glass sand	613,796	623,395	156,878	253,732	297,208
Salt, all types thousand tons	1,783	2,200	2,398	3,330	NA
Stone, sand, and gravel, not elsewhere specified:					
Crushed and broken:					
Dolomite	239,551	266,690	r 305,681	349,890	377,161
Limestone e thousand tons	7,073	7,185	8,106	8,969	9,969
Marble	24,259	14,486	19,594	18,005	3,658
Strontium minerals	5,461	2,620	5,685	2,543	3,458
Sulfur, elemental:					
Frasch process	1,662,016	1,505,015	1,637,299	1,818,928	1,607,597
Other native (mined)	26,406	34,342	29,792	23,920	24,306
Byproduct (from natural gas)	36,866	46,722	38,772	48,307	53,045
Sulfates, natural, sodium	189	26,113	47,895	68,757	NA
Talc and related materials, talc	785	3,387	2,510	2,918	641
Wollastonite	15,553	5,811	3,210	1,504	69
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous thousand tons	2,138	2,006	2,101	2,388	2,605
Coke:					
Coke do	786	824	865	r 1,030	1,153
Coke breeze	21,138	20,874	21,819	58,851	NA

See footnotes at the end of the table.

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Table 2.—Mexico: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
MINERAL FUELS AND RELATED MATERIALS—Continued					
Gas:[4]					
Manufactured, all types million cubic feet	8,489	5,382	6,251	6,531	NA
Natural:					
Production do	485,057	493,161	529,128	572,832	576,871
Marketed do	234,636	249,844	255,128	275,502	285,430
Petroleum:					
Crude oil [5] thousand 42-gallon barrels	129,504	132,141	135,021	149,924	160,486
Refinery products:					
Gasoline:					
Aviation do	695	791	663	639	520
Motor do	36,002	37,674	36,646	40,984	43,910
Kerosine do	12,188	11,906	11,665	12,076	11,812
Jet fuel do	955	1,070	1,605	1,984	2,243
Distillate fuel oil do	20,682	21,020	21,771	23,746	26,567
Residual fuel oil do	39,953	41,880	40,320	43,428	43,057
Liquefied petroleum gas do	6,734	8,452	8,569	9,152	11,079
Lubricants do	1,270	1,409	1,342	1,394	1,370
Asphalt, refinery do	2,321	3,173	6,035	6,289	6,844

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Calculated equivalent.
[2] For export.
[3] Ammonium sulfate only.
[4] Converted at 35.3145 cubic feet per cubic meter.
[5] Includes natural gas liquids.

Note: "Mine production," where listed, is the total metal content of all products, such as, concentrate, matte, precipitate, and impure metal for export, plus content of products processed in Mexico.

TRADE

The United States was by far Mexico's most important trading partner in terms of value, supplying 63 percent of all commodity imports and receiving the same percentage of exports. As a unit, the Americas supplied 68 percent of Mexico's imports and received 74 percent of exports. Europe, as a whole, supplied 26 percent of the imports and received 17 percent of the exports.

Table 3.—Mexico: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destination, 1967
METALS			
Aluminum:			
Oxide (alumina)	6	(1)	Mainly to Ecuador.
Metal, including alloys, all forms	612	1	Mainly to United States.
Antimony:			
Ore and concentrate	14,493	9,555	All to United States.
Metal, including alloys, all forms	322	188	Do.
Arsenic:			
Trioxide, pentoxide and acids	9,409	8,252	Do.
Metal, including alloys, all forms	1,638	2,455	Do.
Bismuth, metal, including alloys, all forms	521	596	Mainly to United States.
Cadmium:			
Intermediate metallurgical products	1,064	724	Do.
Metal, all forms	65	189	Do.
Copper:			
Ore and concentrate	r 5,742	2,088	Do.
Copper sulfate	1,298	965	Brazil 835; United States 130.
Metal, including alloys, all forms	12,329	7,711	Japan 3,175; United States 3,130.
Gold, metal, unworked or partly worked troy ounces	7,196	3,265	All to United States.
Iron and steel:			
Ore and concentrate	120	78	United States 57; West Germany 21.
Metal:			
Scrap	98	139	All to United States.
Steel, primary forms: Ingots	10	57	Mainly to United States.
Semimanufactures	123,542	101,574	Do.

See footnotes at the end of the table.

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Table 3.—Mexico: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destination, 1967
METALS—Continued			
Lead:			
Ore and concentrate	2,498	919	Do.
Oxides:			
Litharge	28,923	30,991	United States 22,819; Italy 3,000.
Red lead	2,622	2,938	United States 1,460; West Germany 364; Italy 343.
Metal, including alloys:			
Antimonial and other bars	15,361	12,100	Netherlands 7,208; United States 2,748; Venezuela 1,272.
Refined bars	98,559	83,860	United States 56,721; Italy 8,943.
Manganese, ore and concentrate	40,606	10,449	Mainly to United States.
Mercury, 76-pound flasks	19,538	12,698	Do.
Molybdenum, concentrate	65	11	Mainly to Japan.
Nickel, metal, including alloys	-------	2	All to West Germany.
Silver, metal, thousand troy ounces	34,245	28,985	West Germany 12,857; Switzerland 5,500; United States 3,941.
Tin, concentrate, long tons	-------	2,649	All to United States.
Tungsten, concentrate	223	260	Mainly to United States.
Zinc:			
Ore and concentrate	312,934	291,072	Do.
Oxide, white	7,987	7,782	Do.
Sulfate	1,049	2,556	All to United States.
Metal, including alloys:			
Powder	1,339	295	Mainly to United States.
Unwrought, refined	32,606	33,086	United States, 14,575; Brazil 12,017 Chile 2,650.
Unwrought, crude	-------	219	All to India.
Other metals and metallic residues	488	631	Mainly to United States.
NONMETALS			
Abrasives, natural:			
Emery, kilograms	2,092	1,630	Mainly to El Salvador.
Pumice	6,723	3,654	Mainly to United States.
Asbestos	21	10,603	Mainly to Bahamas.
Barite and witherite	192	119	All to United States.
Cement	1,956	1,563	Do.
Clays and clay products: Crude clays, n.e.s.:			
Bentonite	65	1	Mainly to Peru.
Fuller's and other earths	4	164	Peru 100; Colombia 51.
Other clays, including refractory	282	108	Venezuela 39; Peru 32; Colombia 13.
Diamond, industrial, carats	15,000	-------	
Diatomite, infusorial earth, tripoli and chalk	3,628	2,798	Argentina 1,680; Colombia 204.
Feldspar	779	151	All to Guatemala.
	37,053	34,418	Mainly to United States.
Fertilizer materials:			
Crude	37,053	34,418	Mainly to United States.
Manufactured:			
Nitrogenous	6,023	1,329	Mainly to Guatemala.
Phosphatic	642	591	Do.
Potassic	1,530	357	Do.
Other, including mixed	14	1,910	All to Guatelama.
Fluorspar:			
Acid grade	241,765	248,930	Mainly to United States.
Metallurgical grade	501,429	507,349	United States 384,324; Canada 123,025.
Graphite, natural	31,173	38,722	Mainly to United States.
Gypsum:			
Crude	979,614	873,945	Do.
Calcined	22	70	Do.
Lime	17	32	All to United States.
Mica, all forms	20	234	United States 139; Colombia 40.
Precious and semiprecious stone, except diamond, kilograms	2,346	367	Mainly to Japan.
Salt, thousand tons	850	2,760	Japan 1,707; United States 793.
Stone, sand, and gravel:			
Dimension stone	10,305	7,440	All to United States.
Crushed rock	209	291	Mainly to United States.
Limestone and dolomite	495	395	Do.
Quartz	1,304	1,129	All to United States.
Sand and gravel	8,092	12,409	Guatemala 8,985; United States 3,422.
Sulfur, elemental, all forms, thousand tons	1,504	1,637	United States 617; Bahamas 253; France 214; United Kingdom 167.
Talc, soapstone, and pyrophyllite	18	41	Mainly to United States.
Other nonmetals, n.e.s.: Crude:			
Calcite	175	210	Do.
Strontium minerals	6,302	2,832	All to United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and natural bitumen	r 459	285	Mainly to United Kingdom.
Coal and coke	9	18	Mainly to Guatemala.

See footnotes at the end of the table.

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Table 3.—Mexico: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destination, 1967
MINERAL FUELS AND RELATED MATERIALS—Continued			
Gas, hydrocarbon:			
Natural—million cubic feet	16,096	54,365	All to United States.
Natural gas liquids	828	590	United States 259; Guatemala 229; El Salvador 102.
Petroleum:			
Crude—thousand 42-gallon barrels	10,183	9,901	Mainly to United States.
Refinery products:			
Gasoline—do	82	318	All to United States.
Distillate fuel oil—do	442	24	Japan 9; United States 7; Liberia 5.
Residual fuel oil—do	7,255	7,727	Mainly to United States.
Lubricants—do	1,843	374	Guatemala 198; United Kingdom 78.
Mineral jelly and wax—do	6,807	8,784	Mainly to United States.

r Revised.
[1] Less than ½ unit.

Source: Secretaría de Industria y Comercio, Dirección General de Estadística. Anuario Estadística del Comercio Exterior de los Estados Unidos Mexicanos, 1967, 746 pp.; 1968, 784 pp.

Table 4.—Mexico: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	9,888	13,546	Mainly from United States.
Oxide (alumina)	44,190	48,069	Do.
Metal, including alloys, all forms	1,301	4,095	Do.
Antimony, metal, including alloys, all forms	59	3	Do.
Arsenic:			
Trioxide, pentoxides and acids	3	(1)	Do.
Metal, including alloys, all forms	13	13	All from United States.
Chromium:			
Chromite	23,154	28,872	Do.
Oxide and hydroxide	265	197	United States 66; West Germany 41; Belgium 36.
Cobalt, oxide and hydroxide	r 74	74	Mainly from Belgium.
Copper, metals, including alloys:			
Scrap	38	49	Mainly from United States.
Unwrought	12	7	Do.
Semimanufactures	723	687	Do.
Gold, metal, unworked or partly worked—troy ounces	18,127	11,379	Do.
Iron and steel:			
Ore and concentrate	419	15,922	All from United States.
Metal:			
Scrap	720,768	697,289	Mainly from United States.
Pig iron, ferroalloys and similar materials.	37,567	14,423	United States 9,602; Switzerland 4,492.
Steel, primary forms	59,208	115,824	Mainly from United States.
Semimanufactures	145,794	166,452	United States 68,520; Canada 52,683.
Lead:			
Oxides	109	25	Mainly from United States.
Metal, including alloys	39	80	Do.
Magnesium, metal, including alloys, all forms	654	401	Do.
Mercury—76-pound flasks	23	11	Do.
Molybdenum:			
Ore and concentrate	-------	26	All from United States.
Metal, including alloys, all forms	9	15	Mainly from United States.
Nickel:			
Matte, speiss and similar materials	94	72	United States 54; Canada 17.
Metal, including alloys, all forms	r 1,072	1,506	United States 831; Canada 237.
Platinum-group metals, metals, including alloys, all forms:			
Palladium—troy ounces	5,746	5,621	United States 1,854; Spain 1,741; France 1,802.
Platinum—do	r 3,902	1,678	West Germany 358; Belgium-Luxembourg 331; United States 322.
Silver, metal, including alloys—do	10,980	21,283	Mainly from United States.

See footnotes at the end of the table.

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Table 4.—Mexico: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Tin:			
Ore and concentrate—long tons	1,004	1,689	United States 780; Bermuda 708.
Oxide—do	60	50	United Kingdom 39.
Metal, including alloys, all forms—do	r 498	86	Mainly from United States.
Titanium:			
Oxides	104	17	Do.
Ore and concentrate	336	649	Australia 360; United States 264.
Slag and residues	12,269	22,360	All from Canada.
Tungsten, metal, including alloys, all forms	17	26	All from United States.
Uranium, metal	-------	8	Do.
Zinc, metal, including alloys, all forms	63	102	United States 65; West Germany 23.
Zirconium, ore and concentrate	1,550	1,279	Mainly from Australia.
Other:			
Ore and concentrate, n.e.s	48	59	Mainly from United States.
Metals and alloys, n.e.s	r 67	348	Do.
Scrap of nonferrous metals, n.e.s	94	99	Do.
NONMETALS			
Abrasives, emery and carborundum in powder and grains	680	409	West Germany 142; United States 117; Austria 104.
Asbestos, crude	25,526	30,568	Canada 22,750; United States 5,612.
Barite	452	461	West Germany 290; United States 150.
Boron materials, oxide and acid	1,936	1,572	Mainly from United States.
Cement	r 9,353	3,089	Do.
Clays, crude:			
Fuller's earth	485	600	Do.
Kaolin	13,413	13,102	Do.
Refractory	90,240	82,427	Do.
Other	1,752	568	Do.
Cryolite	380	45	Do.
Diamond:			
Gem, not set or strung—carats	13,580	6,180	Belgium 3,875; Netherlands 1,475.
Industrial—do	50,000	35,000	Mainly from United States.
Powder—do	85,000	35,000	All from United States.
Diatomite	80	49	Mainly from United States.
Feldspar	1,462	1,792	Do.
Fertilizer materials: Manufactured:			
Nitrogenous	r 112,222	124,525	Netherlands 50,200; Japan 48,993; Chile 15,000.
Phosphatic	289,774	342,531	Mainly from United States.
Potassic	r 48,100	44,523	Do.
Other	3,862	4,868	Mainly from Chile.
Fluorspar	71	2	All from United States.
Graphite	133	62	Do.
Gypsum	r 11,624	15,685	Mainly from United States.
Lime	8,729	10,306	Do.
Magnesite	39,865	31,762	Do.
Mica:			
Crude and powder	197	128	United States 78; Argentina 44.
Scrap	42	59	All from United States.
Precious and semiprecious stones, except diamond—kilograms	r 636	48	Mainly from Chile.
Salt	1,131	5,415	Mainly from United States.
Sodium and potassium compounds:			
Caustic soda	24,668	32,787	Do.
Potassium hydroxide	960	1,064	Belgium-Luxembourg 383; United States 343; West Germany 324.
Stone, sand and gravel:			
Dimension stone, roughly worked	r 2,817	6,594	Mainly from Italy.
Dolomite	50	50	All from United States.
Gravel, crushed and paving stone	366	732	Mainly from United States.
Sand	132,397	107,228	Do.
Quartz	28	58	Do.
Sulfur	r 247	312	Do.
Talc and pyrophyllite:			
Talc:			
Crude	46,648	35,553	Do.
Powdered	618	391	United States 271; Italy 120.
Pyrophyllite	88	120	All from United States.
Vermiculite	577	393	Do.
Other nonmetallic minerals	r 2,183	2,690	Do.
MINERAL FUELS AND RELATED MATERIALS			
Coal	63,796	61,918	Mainly from United States.
Coke	124,807	147,321	All from United States.

See footnotes at the end of the table.

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Table 4.—Mexico: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS—Continued			
Gas, hydrocarbon:			
Natural gas.....million cubic feet..	8,809	9,669	Do.
Natural gas liquids. thousand 42-gallon barrels..	r 6,669	6,975	Do.
Petroleum:			
Crude.....do....	633	524	Do.
Refinery products:			
Aviation gasoline.....do....	282	165	United States 120; Netherlands Antilles 45.
Motor gasoline.....do....	1,241	540	Netherlands Antilles 497; United States 43.
Kerosine.....do....	107	166	All from United States.
Distillate fuel oil.....do....	(1)	61	Mainly from United States.
Residual fuel oil.....do....	318	1,727	All from United States.
Lubricants including greases.....do....	r 418	199	Mainly from United States.
Asphalt.....do....	4	4	All from United States.
Paraffin and vaseline.....do....	189	218	Do.
Other.....do....	619	637	Mainly from United States.

r Revised.
1 Less than ½ unit.

COMMODITY REVIEW

METALS

Aluminum.—Aluminio, S.A. de C.V., an affiliate of Aluminum Company of America, (Alcoa) increased ingot production to 22,518 tons, a 4.7-percent rise over the 1967 level. Expected increased output in 1969, made possible by expansion of plant facilities, may lead to a small surplus for export. Capacity at yearend was 33,000 tons annually and by 1971 is expected to be 45,000 tons, when the second stage of the expansion program is completed.

Alumina is imported from Alcoa's plant in Texas, and electric power is available from the new Malpaso Dam in Chiapas.

Copper.—Asarco Mexicana, S.A., contracted with the Mexican Government to explore a porphyry copper prospect (La Caridad) in the Nacozari, Sonora, area. The prospect was originally found through the joint efforts of the Mexican Government and the United Nations. If exploration proves the presence of an adequate ore body, present Government plans contemplate a mining-milling joint venture with participation of major Mexican mining companies. Asarco has an option to acquire a 49-percent interest in the property and to manage it should development be feasible.

Asarco Mexicana was also developing a copper property at Inguarán, Michoacán, having reserves of 4.1 million tons of ore averaging 2 percent copper and 0.3 ounce of silver a ton. Total investment was estimated at $12.8 millon. This included mining equipment, flotation mill, and expansion of the company's smelter at San Luis Potosí, which will treat the additional output. A milling rate of 2,000 tons a day, and a smelter copper production of 1,000 tons a month was planned.[6]

Iron Ore.—Cía. Fundidora de Fierro y Acero de Monterrey proved 44 million tons of iron ore in Coahuila and was continuing its drilling program. It was planned to install a 2,000-ton-per-day crushing plant.

Consorico Minera Peña Colorada, in which four Mexican steel companies and the Federal Government participate, is developing the Peña Colorada iron ore deposits for pellet production. The estimated 130 million tons of ore was said to average 41 percent iron rather than 60 percent as previously reported. Pellets produced from the ore on an experimental basis averaged 67 percent iron. If present studies demonstrate the feasibility of large-scale pellet production, construction of a 1.5 million-ton-per-year plant at the mine may follow.

Iron and Steel.—Altos Hornos de México, S.A., planned to expand its facilities over

[6] Engineering and Mining Journal. V. 10, No. 4, April 1969, p. 170.

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the next 3 years at a cost of $640 million. Construction of a new Linz-Donawitz (LD) furnace and of a continuous casting plant was in progress. The company expects to raise its capacity to 2 million tons a year by the end of 1970.

Fierro y Acero de Monterrey completed its third blast furnace and a new cold reduction mill during the year. The company expected an output of 1 million tons in 1970.

Hojalata y Lamina, S.A., was building an integrated plant at Puebla with expected annual capacity of 300,000 tons of special steel rods and construction beams.

Aceros Nacionales was investing $20 million in facilities for steel wire production.

Other steelmakers were expanding their facilities, with emphasis on special steels.

Manganese.—Cía. Autlán S.A., in which Bethlehem Steel Co. has a minority interest, continued development of a manganese carbonate property in the vicinity of Pachuca and Zimapán. The area has been known in the past for lead-silver-zinc production, but not as a manganese area. It was planned to produce 100,000 tons of ore a year, when full operation is attained. Construction of facilities started in 1967, and initial production began in February 1968.

The project is based on two mines: (1) The Acoxcatlán property, an underground operation with estimated ore reserves of 7 million tons and (2) the Tesintla mine which lies on the apex of a sharp fold and will be worked by open-pit methods. The mine-run averages 22.5 percent manganese but will be upgraded to 36 percent by nodulizing in a 16-inch-diameter Traylor kiln. The ore is said to be self-fluxing and thus equivalent to a 44- to 45-percent-manganese product. Maximum specification ratios in relation to manganese content are 0.26 to 1 for silica plus alumina and 0.19 to 1 for iron. Total production is to be divided about equally between the two mines. The ore is to be exported from the port of Tampico to the United States.

NONMETALS

Dickite.—A large deposit of dickite, a clay mineral, was described in 1968. Lying near Mexico Highway 49, 3½ kilometers east of Guadalupe in the State of Zacatecas, the material was being used for the manufacture of refractories. The deposit is controlled by Refractarios A.P. Green, S.A., of Mexico City.[7]

Fertilizer Materials.—Guanos y Fertilizantes, S.A., invested over $6 million in expanding its sulfuric acid, ammonium sulfate, and simple superphosphates plant. It was expected that with proposed daily output of 400 tons of ammonium sulfate, Mexican imports of this material would decline considerably.

Fertilizantes Certificados de Mexico, S.A., inaugurated its $500,000 chemical fertilizer plant early in 1968 at Ciudad Juarez. Backed by Adela Investment Corp., Investigaciones y Promociones Industriales, S.A., and Producers Chemical Corp., the plant was to produce 180,000 tons annually of simple superphosphate fertilizer. All raw materials will come from the United States, and it was expected that the finished product would be exported to the United States. This project is part of the Border Industrialization program which is being encouraged by the Mexican Government.

Fluorspar.—Continued strong demand for fluorspar in the United States prompted the producing industry in Mexico to expand its production. The result was an 18-percent increase over 1967 production.

Asarco Mexicana S.A., in which American Smelting and Refining Co. owns a 49-percent interest, completed its fluorspar recovery plant at Parral, Chihuahua, in 1968. Rated to produce 77,000 tons of acid-grade fluorspar annually from mill tailings, this may be the largest fluorspar flotation plant in the world. Initial output was 3,000 tons a month, but when the usual startup problems are solved, full production capacity should be attained.

San Francisco Mines, in the same area, also recovers fluorspar from mill tailings; its plant is rated at 60,000 tons annually.

Minera Continental, S.A., which controls Fluorita de México and Fluorita de Rio Verde, improved and modernized its fluorite mining and milling facilities.

Most Mexican fluorite was exported to the United States with lesser amounts going to Canada and Japan; annual domestic consumption was estimated at about 5 percent of total output.

In 1969 some 35 companies produced fluorite. The following parent companies,

[7] Hanson, R. F., and Keller, W. D. New Occurrence of Commercial Dickite in Mexico. Geological Society of America, ann. meeting, Mexico City, Nov. 1968, program with Abs., 1968, p. 126.

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largely foreign, had substantial interest in the major portion of the production: American Smelting and Refining Co., Continental Ore Co., Noranda Mines, Allied Chemical Corp., Pennsalt Chemical Co., The Dow Chemical Co., Reynolds Mining Corp., and Alcan Aluminium Ltd.

Sulfur.—Cía. San Noe, S.A. de C.V., in which Pan American Sulphur Co. has a 34-percent interest, found sulfur in three exploratory tests; the company was granted an additional 9,500 acre tract adjoining the discovery to drill more exploratory holes to prove the deposit. Details of the discovery were not divulged except that the sulfur occurred "at depth capable of being mined with the Frasch process."[8]

Union Minera del Sur, S.A. de C.V., in which Cities Service Co. has a 34-percent share, found sulfur at depth near Coatzacoalcos. The discovery was made on one of five tracts totaling 30,000 acres. Additional drilling was in progress in order to determine the extent of the deposit.

Sotavento, S.A. de C.V., found sulfur mineralization at depths feasible for mining by the Frasch process; further drilling was being carried on to prove the deposit. Hooker Chemical Corp., a wholly owned subsidiary of Occidental Petroleum Corp., owns a 34-percent interest in Sotavento.

Water.—It was expected that the largest commercial desalting plant in the world would be completed at Rosarito by yearend. Located 12 miles south of Tijuana, the plant should be capable of producing 7.5 million gallons of potable water daily. The $7 million plant was designed and erected by Aqua-Chem, Inc., and freshwater cost was calculated at 65 cents a thousand gallons. The water will be mixed with Tijuana's present source of water and was expected to eliminate the city's water problem, at least for the time being.

MINERAL FUELS

Coal.—Cía. Fundidora de Fierro y Acero de Monterrey, S.A., was to enlarge the coke oven capacity of Hullera Mexicana, S.A., an affiliate company. Koppers Co., Inc., gained the contract to furnish engineering services and some material to construct a battery of 81 coke ovens at Las Esperanzas, Coahuila. The battery was planned for output of 57,000 tons of blast furnace coke monthly. Construction will be done by Mexican contractors.

Petroleum.—Petróleos Mexicanos (Pemex), a Government organization, was essentially the only producer, refiner, and dealer in petroleum and natural gas in Mexico. Total production in 1968 was 160.5 million barrels, made up of 142 million barrels of crude oil, 103,000 barrels of condensate, and 18 million barrels of natural gas liquid, a gain of 7 percent over 1967 output totals. In addition, natural gas production was 577 billion cubic feet, which had a calorific equivalent of 98.2 million barrels of crude oil.

Wells drilled for exploration and development needs totaled 602. The importance of exploration was indicated by the 46.5 percent of the investment budget devoted to exploration and development.

Exploration drilling led to the discovery of 20 new fields and 18 extensions; of these, 10 oilfields and 12 gasfields were considered of commercial importance. Offshore drilling continued as the No. 2 Arenque (off Tampico) tested 4,000 barrels a day from a newly discovered horizon. The Atún area, offshore from Poza Rica, was producing 12,000 barrels a day from four wells at yearend. The Reynosa Oriente No. 1, in the Reynosa field, was drilled to 5,530 meters. Gas was encountered in a sandy horizon below 4,500 and good gas production was indicated. At Poza Rica a new producing horizon was discovered which may lead to substantial new reserves in the field.

Reserves for Mexico at yearend were put at 5,530 million barrels, a slight increase over those at yearend 1967. The total reserve[9] figure was divided as follows, in million barrels: Oil, 2,744; condensate, 423; and gas, converted to barrels, 2,364. At the present rate of consumption, the reserves are adequate for 22 years' supply.

Dry gas reserves at yearend were estimated at 11.8 trillion cubic feet.

The Director General of Pemex declared that the chief aim of the organization was to supply the domestic market—not to generate exports, but to eliminate imports.

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[8] Industrial Minerals (London, England). October 1968, No. 13, p. 27.
[9] Petróleos Mexicanos. Memoria de Labores. 1968, p. 55.

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The Mineral Industry of Morocco

By Henry E. Stipp [1]

The mineral industry decreased further relative to the general economy in 1968; minerals production accounting for only 5.7 percent of the gross national product of $2,979 million.[2] The number of persons employed by the mineral industry also decreased to 27,624 compared with 29,711 in 1967. The largest number of persons was employed in the phosphate mining sector (13,070), followed by coal (4,173), lead and zinc (4,050), and iron mining (2,202). Total expenditures under the Government's new 5-Year Plan (1968–72) were scheduled at $998 million, of which mining would receive $59 million. Half of this would be for prospecting. A total of $153 million would be for the construction of dams and $57 million would be allotted to industry in general. In August Jawad Ben Brahim replaced Moulay Ahmed Alaoui as Minister of Mines, Industry, Commerce and Merchant Marine.

PRODUCTION

The total value of mineral commodities produced by Morocco in 1968 decreased 1.2 percent to $171 million from $173 million[3] in 1967. This drop in minerals output was mainly due to the sharp decline in production of manganese ore (44 percent), zinc concentrate (18 percent), crude petroleum (16 percent), barite (14 percent), and cobalt concentrate (13 percent). However, substantially increased production of salt (105 percent), clays (31 percent), silver (19 percent), pyrrhotite (18 percent), cement (16 percent), and phosphate rock (6 percent) helped to cushion the overall decline. The most important mineral commodities produced in terms of value were phosphate rock, $103 million; lead concentrates, $16 million; cement, $15 million; lead metal, $5 million; coal, $5 million; and iron ore, almost $5 million.

The sizable increase in the production of phosphate rock resulted from larger demand for fertilizers in overseas markets and increased efficiency of mining operations.

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[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from dirhams (DH) to U.S. dollars at the rate of DH5.06 = US$1.

[3] Value figures for total mineral production have been revised to include the value of cement based upon the unit value of cement exports in 1967.

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Table 1.—Morocco: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Antimony concentrate:					
Gross weight	3,282	4,586	2,685	3,178	2,694
Metal content	1,560	2,200	1,343	1,589	1,212
Cobalt concentrate:					
Gross weight	15,253	16,654	18,130	17,530	15,179
Metal content	1,678	1,832	1,994	1,928	1,518
Copper concentrate:					
Gross weight	6,504	6,278	8,940	8,421	9,521
Metal content	1,748	1,813	2,682	2,526	3,047
Iron ore, direct shipping—thousand tons	888	951	1,017	884	809
Lead concentrate:					
Gross weight	103,944	113,259	119,380	116,336	120,636
Metal content	71,290	77,111	77,597	52,351	72,382
Metal, primary	18,839	17,232	18,775	21,359	24,166
Manganese:					
Ore, metallurgical	266,400	321,429	284,660	197,753	86,437
Ore, chemical	74,678	54,452	77,760	88,385	73,774
Nickel, content of cobalt ore [e]	336	360	390	350	302
Silver, metal, primary—thousand troy ounces	604	599	707	773	920
Tin:					
Mine output, metal content—long tons	14	[r] 15	[r] 11	[r] 10	19
Metal, primary—do	10	12	12	[r] 12	15
Zinc concentrate:					
Gross weight	80,974	95,015	94,249	[r] 82,915	67,620
Metal content	42,346	51,218	53,722	45,521	31,781
Oxides; metallic, mainly for pigment	864	910	544	--------	--------
NONMETALS					
Barite	89,844	103,880	106,255	90,518	78,160
Cement—thousand tons	927	790	857	858	996
Clays:					
Smectite and bentonite	32,289	51,760	40,950	33,861	43,759
Other, including fuller's earth	4,305	6,789	2,480	4,015	4,380
Fertilizer materials: Crude (natural):					
Phosphate rock—thousand tons	10,098	9,824	9,439	9,945	10,512
Fluorspar, all grades	6,570	3,000	--------	--------	--------
Gypsum, crude [e]—thousand tons	50	70	80	90	--------
Pyrite (including cupriferous)	21,220	18,318	14,896	--------	--------
Pyrrhotite	------	128,014	282,311	353,153	417,851
Salt, all types—thousand tons	61	34	39	20	[2] 41
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—thousand tons	400	419	451	482	451
Briquets—do	18	18	20	([3])	18
Gas, natural, marketed—million cubic feet	412	402	389	379	382
Petroleum:					
Crude oil—thousand 42-gallon barrels	910	782	783	738	620
Refinery products:					
Gasoline—do	1,442	2,072	2,074	2,178	2,429
Kerosine—do	490	504	518	506	574
Distillate fuel oil—do	2,187	2,532	3,264	3,078	3,050
Residual fuel oil—do	2,345	2,438	3,024	2,897	2,974
Other, mainly liquefied petroleum gas—thousand 42-gallon barrels	[e] 712	352	379	477	573
Total—do	[e] 7,176	7,898	9,259	9,136	9,600

[e] Estimate. [r] Revised.

[1] In addition to commodities listed, Morocco also produces small quantities of copper matte from lead smelting, phosphatic fertilizer, and various quarry products, but production data are not available.

[2] Rock salt.

[3] Included with Anthracite.

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TRADE

Morocco's trade balance in mineral commodities remained favorable in 1967, but the total trade balance continued in deficit as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	168	430
1966	166	428
1967	164	424
Imports:		
1965	63	453
1966	43	478
1967	43	518

France was Morocco's principal trading partner followed by West Germany, United Kingdom, U.S.S.R. and United States, as shown as follows in millions of U.S. dollars:

Country	Morocco's imports	Percent of total	Morocco's exports	Percent of total
France	194	37	175	41
Germany, West	47	9	34	8
U.S.S.R.	19	4	16	4
United Kingdom	18	3	24	6
United States	53	10	10	2
Other	187	36	165	39
Total	518	99	424	100

Exports of mineral commodities in 1967 consisted mainly of phosphate rock, valued at about $108 million; lead concentrate, valued at almost $12 million; manufactured phosphate fertilizers, valued at more than $10 million; manganese ore, valued at more than $8 million; iron ore, valued at about $7 million, and zinc concentrate, valued at more than $5 million.

The principal mineral commodities imported into Morocco in 1967 and their valuation was as follows: Crude petroleum, $16 million; petroleum refinery products, more than $7 million; iron and steel semimanufactured products almost $5 million; copper and copper alloys, about $3 million; and aluminum and its alloys, $2 million. West European countries, mainly France, supplied the largest part of metal and mineral commodity imports. Crude petroleum came chiefly from the U.S.S.R., Saudi Arabia, and Libya. Petroleum refinery products were supplied mainly by the Netherlands Antilles, Spain, and France.

In 1968 exports of phosphate rock totaled more than 10 million tons. Shipments went principally to France, 1.8 million tons; Belgium, 1.2 million tons; and United Kingdom, 1.1 million tons. Other mineral commodity exports in 1968 were as follows: Iron ore, 659,107 tons; manganese ore and sinter, 160,918 tons; lead concentrate, 85,489 tons; zinc concentrate, 79,354 tons; lead metal, 22,950 tons; silver, 915,138 troy ounces; copper ore and concentrates, 6,446 tons; cobalt concentrate, 18,093 tons; antimony concentrate, 2,476 tons; barite, 81,657 tons; bentonite clay, 11,048 tons; smectic clay, 15,285 tons, and montmorillonite clay 1,977 tons.[4]

A report describing the foreign trade regulations of Morocco was published.[5] The paper gives information that will be of value to U.S. firms interested in the sale or purchase of mineral commodities in Morocco.

[4] Kingdom of Morocco, Agency of Commerce and Industries of Mines and Mercantile Marine. Statement of Statistics of Production, of Exports, and of Local Sales of Minerals, December 1968, 6 pp.

[5] U.S. Department of Commerce. Overseas Business Reports. OBR 68-102, December 1968. 8 pp.

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Table 2.—Morocco Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	594	479	Italy 347; France 50.
Antimony, ore and concentrate	3,220	3,324	Belgium-Luxembourg 944; France 829; Spain 500.
Cobalt, ore and concentrate	19,535	15,565	France 12,560; Belgium-Luxembourg 3,005.
Copper:			
Ore and concentrate	7,652	7,558	West Germany 2,873; China, (mainland) 2,181; Poland 1,906.
Matte	42	167	Italy 95; Netherlands 36.
Iron and steel:			
Ore, direct shipping—thousand tons	790	916	Spain 290; West Germany 232; United Kingdom 218.
Roasted pyrite	14,600	5,130	Spain 3,555; West Germany 1,575.
Scrap	28,257	34,868	Italy 19,565; Japan 11,509.
Ferroalloys	22	36	Netherlands 20; United Kingdom 16.
Semimanufactures	407	1,050	Italy 600; Cuba 230; France 106.
Lead:			
Ore and concentrates	91,998	86,431	France 39,607; Italy 16,825; West Germany, 12,801.
Unwrought and scrap	15,577	20,061	France 16,866; United States 2,189.
Magnesium metal, including alloys: Scrap and ingot.	3	7	All to Belgium-Luxembourg.
Manganese, ore and concentrate. thousand tons	294	215	France 109; United States 29.
Silver, metal including alloys, unworked. thousand troy ounces	4,000	-------	
Zinc, ore and concentrate	80,007	86,708	France 54,382; United States 21,467.
Other:			
Ore and concentrate, n.e.s	1,827	3	All to United States.
Slags and residue, n.e.s	1,485	507	France 487.
Oxides of metals, mainly for paint	433	1,000	All to United Kingdom.
NONMETALS			
Barite	98,303	89,116	United States 43,740; United Kingdom 9,500.
Cement	20,036	16,581	Spain 12,281; Saudi Arabia 3,300.
Clays and clay products (including refractory brick):			
Bentonite	112	158	All to United Kingdom.
Fuller's earth	1,344	4,199	Tunisia 3,138; Algeria 1,045.
Refractory	1,753	1,655	Spain 1,568.
Smetic	28,123	21,633	France 12,176; Spain 9,457.
Products	32	-------	
Fertilizer materials:			
Crude:			
Guano	3,631	-------	
Phosphate rock—thousand tons	9,203	9,342	France 1,821; United Kingdom 893; Belgium-Luxembourg 876.
Manufactured: Phosphatic	139,151	187,088	Bulgaria 89,538; South Korea 29,825; Netherlands 20,442.
Gypsum and plasters	49,554	50,688	Japan 32,398; Portugal 15,140.
Lime	239	165	All to Spain.
Salt and brines	1	2	All to Gibraltar.
Stone, sand and gravel:			
Dimension stone and other	7,732	6,972	Italy 3,286; Spain 1,699; Belgium-Luxembourg 1,448.
Crushed rock	96	1,229	Spain 864; ships stores, foreign 360.
Sand, mainly industrial	16,312	8,945	Spain 8,895.
Sulfur:			
Elemental, crude	104	-------	
Sulfuric acid	-------	85	All to Algeria.
Other nonmetals, n.e.s	1,547	1,907	Denmark 1,000; Spain 500; East Germany, 250.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite—thousand tons	28	68	Italy 32; Algeria 22; France 11.
Coke and semicoke	20	-------	
Petroleum:			
Refinery products:			
Gasoline thousand 42-gallon barrels	16	10	All to Malta.
Kerosine and jet fuel—do	72	83	Ships stores, foreign 69; ships stores, China, mainland 12.
Distillate fuel oil—do	-------	62	Ships stores, foreign 43; ships stores, France 19.
Residual fuel oil—do	2	7	All to ships stores, France.
Lubricants—do	[2]	[2]	
Liquefied petroleum gas	[2]	[2]	
Other:			
Bitumen—do	-------	2	Spain 1; Netherlands Antilles 1.
Total—do	90	164	

[1] Source: Royaume Du Maroc, Statistiques Du Commerce Exterieur, 1967.
[2] Less than ½ unit.

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Table 3.—Morocco: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Aluminum:		
Bauxite and concentrate	1,000	2,000
Metal, including alloys, all forms	1,614	2,544
Antimony, metal, including alloys, unwrought	15	------
Copper, metal, including alloys, all forms	2,348	2,321
Iron and steel:		
Metal:		
Scrap	82	5
Pig iron, ferroalloys, and similar materials	1,814	938
Semimanufactures	14,339	15,527
Lead, metal, including alloys, all forms	62	8
Manganese, ore and concentrates	20	------
Mercury, 76-pound flasks	14	4
Molybdenum, metal, including alloys, unwrought, kilograms	45	98
Nickel, metal, including alloys, all forms	232	370
Silver, metal, including alloys, all forms, troy ounces	632	289
Tin, metal, including alloys, all forms, long tons	142	274
Zinc, metal, including alloys, all forms	834	978
Other:		
Ore and concentrate, n.e.s., thousand tons	1,809	------
Slags and residues, metallic	1,000	------
Oxides of metals, mainly for paint	1,662	808
NONMETALS		
Abrasives, natural	40	15
Asbestos	2,494	2,198
Barite and witherite	1	2
Boron materials: Borates, sodium, refined	537	554
Cement	7,075	8,170
Chalk	3,143	2,847
Clays and clay products (including refractory brick):		
Crude clays, n.e.s.:		
Fuller's earth	11	40
Kaolin and refractory	16,300	14,545
Smectic	38	4,647
Other	624	274
Products	3,937	8,027
Diatomite and other infusorial earths	747	936
NONMETALS—Continued		
Fertilizer materials:		
Crude, all types	193	448
Manufactured:		
Nitrogenous	4,724	25,353
Potassic	15,294	28,334
Other, including mixed	8,074	13,303
Ammonia	63,724	89,824
Graphite, natural	19	8
Lime	624	270
Salt and brines	52	70
Sodium and potassium compounds, n.e.s.:		
Caustic soda	5,757	6,062
Caustic potash, sodic and potassic peroxides	51	90
Stone, sand and gravel:		
Dimension stone	358	621
Dolomite, chiefly refractory grade	507	658
Gravel and crushed rock:		
Crushed rock	159	14
Sulfur:		
Elemental, all forms	13,878	8,384
Sulfuric acid	12	11
Talc, steatite, soapstone and pyrophylite	1,618	787
Other nonmetals, n.e.s	500	176
Oxides and hydroxides of magnesium, strontium, and barium	1,765	(2)
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets thousand tons	33	57
Gas, hydrocarbon (LPG) thousand 42-gallon barrels	53	12
Petroleum:		
Crude, do	7,826	8,228
Refinery products:		
Gasoline, do	70	91
Kerosine, do	210	246
Distillate fuel oil, do	4	158
Residual fuel oil, do	4	133
Lubricants, do	136	137
Mineral jelly and wax thousand 42-gallon barrels	64	68
Other: Bitumen and asphalt thousand 42-gallon barrels	180	196
Total, do	r 668	1,029

r Revised.
[1] Source: Royaume Du Maroc, Statistiques Du Commerce Exterieur, 1967, 542 pp.
[2] Less than ½ unit.

COMMODITY REVIEW

METALS

Antimony.—Morocco was an important source of lump sulfide ore for West European countries, although the 1968 production of 2,694 tons had decreased more than 41 percent from peak production of 4,586 tons in 1965. The largest producer in Morocco was Omnium de Gerance Industrielle et Miniere, which worked three mines in the Oulmès district.[6] Ominum Minier Moghrebin, which owns the Majma Salihine deposit was the second largest producer. Société Nouvelle Union des Metaux Maroc and other smaller producers furnished the remaining part of total output. The Timerghdaudine mine, owned by Société Maracaine de Mines et Produits Chimiques, was mined out and closed down in 1967.

Cobalt.—Geological, geochemical, and

[6] Industrial Minerals (London). No. 12, September 1968, p. 30.

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geophysical studies were to be conducted for deposits of ore under a contract negotiated with the U.S.S.R. organization Technoexport by Compagnie Tifnout Tiranimine.[7] The surveys would be carried out in the Bou Azzer region. Laboratory tests of cobalt ores also will be carried out.

Copper.—Preliminary exploration of a deposit in a sandstone formation reportedly containing an estimated 2 million tons of copper ore averaging 2.0 percent copper, was conducted by Société Miniere du Djebel Aouam.[8] The deposit is located in the Ouaouzarhe district of the Beni-Mellal region of the Middle Atlas Mountains. Exploration and mining rights to the concession were held principally by Djebel Aouam with participation also by the Bank of Paris and the Netherlands (Banque de Paris et des Pays-Bas), and Société Générale de Belgique. Occidental International Minerals Corp., which had been searching for copper deposits in the Anti Atlas Mountain region of southern Morocco, abandoned its activities and closed its office in Rabat at yearend.

Iron and Steel.—The Sétolazar and Uixam mines located near Nador reportedly have reached a crucial stage, because continued operations will require a very substantial investment in new equipment. Ore, which has been mined by open-pit methods, will be exhausted around 1971. In underground areas of the mines, 25 million tons was estimated to be available for exploitation. An aeromagnetic survey of the area did not indicate any other iron ore deposits. The ore remaining underground has a high sulfur content (0.4 percent), and new equipment to remove the sulfur would also be required. The Moroccan Government was reviewing a plan developed in consultation with a Canadian firm, for investment of $24 million in new equipment. This includes new mining machinery, desulfurizing units, a pelletizing plant and new railroad equipment.

The plan to construct an iron and steel mill at Nador, proposed 2 years ago, has been dropped because it was considered to be not economically viable.

Lead and Zinc.—Bureau de Recherches et de Participations Minières (BRPM) concluded working agreements with Technoexport of Bulgaria for a detailed study of lead and zinc deposits and with Tiajromexport of the U.S.S.R. for a technical study of the proposed concentration plant to be located at the Bou Madine deposit near Ksar es Souk.[9] The Société des Mines de Zellidja also was studying a lead deposit at Bou Selham in the eastern High Atlas Mountains. The Zellidja mine on the Moroccan side of the border with Algeria was nearing exhaustion, and it was estimated that the last ore will be removed in about 18 months.[10] The pulling of mine pillars was progressing at a steady pace; however, a section of the flotation plant and smelter was idle. Reserves of ore at the Zellidja mine on the Algerian side of the border were estimated at 10 million tons containing an average of 7.5 percent lead and zinc. In March the Government of Morocco and Algeria signed a treaty providing that 300,000 tons per year of ore mined in Algeria's El Abed mine would be milled by Zellidja for a period of 5 years. Lead concentrate will be smelted at the Oued El Heimer plant jointly owned by Zellidja and Société Miniere et Métallurgique de Peñarroya. The zinc concentrate will be returned to Algeria for export mainly to West European countries.

At the western end of this 18-kilometer-long Zellidja district Compagnie Royale Asturienne des Mines was sinking another shaft at its Touissit mine. Mill capacity was being raised from 240 to 290 tons per hour.

Manganese.—The Moroccan company BRPM signed an accord with the Hungarian company Nikex to construct a concentration plant at Tiouine near Ouarzazate.[11] A small deposit of low-grade manganese ore occurs here.

Silver.—The accord between BRPM and Nikex also provided for exploitation of a silver-lead ore deposit at Imiter near Ksar es Souk. Reserves have been estimated at 544,000 tons of ore containing about 9.6 ounces of silver per ton.

NONMETALS

Cement.—Production of 995,621 tons in 1968 came from five plants located in

[7] Mining Journal. (London). V. 271, No. 6954, Nov. 29, 1968, p. 431.
[8] Mining Journal (London). V. 271, No. 6939, Aug. 16, 1968, p. 113.
[9] Mining Journal (London). V. 271, No. 6940, Aug. 23, 1968, p. 129.
[10] World Mining. V. 4, No. 4, April 1968, p. 7.
[11] Industries Et Travaux D' Outremer (Paris). No. 170, January 1968, p. 56.

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Casablanca, Meknes, Agadir, Tetouan and Tangier. The Casablanca plant produced 700,000 tons of the total output. A large increase in consumption, that totalled 1,015,383 tons, was attributed mainly to growing hotel and private housing construction.

Phosphates.—The mining and preparation for export of phosphate rock occurs in the Khouribga district of Morocco.[12] The Khouribga complex contains several underground mines and two major open-pit mines (Sidi Daoui and Meraa-el-Arech), a washing plant, three drying plants, and a calcination plant. New, large-capacity mechanical equipment will be purchased to raise the open-pit output about 30 percent, and underground mining also will be mechanized in an effort to raise total output of phosphate rock to 18 million tons by 1972. In addition to the Khouribga district, phosphate rock also is mined at Yaussoufia and Ben Guerir. Total reserves of phosphate rock in Morocco are estimated at about 40 billion tons. Morocco's annual sales of phosphate to 35 countries accounted for 80 percent of total export shipments from all Moroccan ports. In 1967 Office Cheriffien des Phosphates, the state mining company, employed 14,000 persons.

Recently discovered deposits of phosphate rock at Ben Guerir, near Marrakesh, were being developed so that production could begin in 1970 at about 650,000 tons per year, rise to 3 million tons per year by 1975, and over the long run increase to 10 million tons per year.[13] Although the phosphate rock is lower in grade than other Moroccan deposits, a washing plant will bring the calcium phosphate content up to 70 percent. After being mined by open-pit methods and concentrated, the products will be transported by rail to the port of Safi for export. Reserves were estimated at 900 million tons.

The chemical complex at Safi converts about 350,000 tons per year of phosphate rock into triple-superphosphate.[14] Production capacity could be expanded to 1 million tons per year with a minimum of engineering work. A plan proposed by Occidental Petroleum Corp. to construct a plant at Casablanca for producing superphosphoric acid has been abandoned, owing to the high cost of sulfur for producing needed reagent sulfuric acid.

MINERAL FUELS

Coal.—The West German firm Entwicklung and Beratunb presented to the Government results of a 2-year study of the Djerada anthracite coal deposits located 24 miles south of Oujda. The study indicated that increasing the annual production from 450,000 tons to 800,000 tons would make the operation profitable. The mined anthracite would be used for electricity production and the manufacture of coke and briquets. In January the Moroccan Government signed an agreement with the U.S.S.R. organization Energo Machexport to construct a thermoelectric powerplant at Djerada.[15] The plant which was to cost about $3.4 million would consume about 400,000 tons of coal and produce a total of 110,000 kilowatts of electric power.

Petroleum.—Esso Exploration Inc., a subsidiary of Standard Oil Co. of New Jersey, found oil in a wildcat well, at depths of between 6,900 feet to 7,000 feet, 22 miles offshore from Tarfaya, southern Morocco.[16] The strike resulted from the second test hole drilled after operations began in July. Commercial potential of the discovery would not be known until further test drillings were made; however, preliminary indications reportedly were promising.

A joint venture between Occidental Petroleum Corp. and the BRPM, a state company, was granted a 4,600-square-mile petroleum concession on and offshore the coast near Ifni and Sous.[17] The exploration agreement covers an 8-year period. If commercial quantities of crude oil are located the concession can be extended for a 30-year period. Occidental expected to start seismic work in 4 months and commence drilling within 10 months. Earlier in the year BRPM and Société Nationale des Pétrolés d'Aquitaine (SNPA) of France agreed to an equal participation in a 5,790-square-mile petroleum concession offshore stretching from El Jadida to Cape Ghir.[18]

[12] World Mining. Moroccan Phosphate. V. 5, No. 1, January 1969, pp. 18–23.
[13] Mining Journal. (London). V. 270, No. 6926, May 17, 1968, p. 396.
[14] FDC Israel Newsletter. V. 8, No. 5, May 1968, p. 5.
[15] Industries Et Travaux D'Outremer. (Paris). No. 182, January 1969, p. 55.
[16] Petroleum Intelligence Weekly. V. 8, No. 1, Jan. 6, 1969, p. 8.
[17] Oil and Gas Journal. V. 67, No. 19, May 12, 1969, p. 115.
[18] Petroleum Intelligence Weekly. V. 8, No. 12, Mar. 24, 1969, p. 8.

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If Petrofina, S.A., a Belgium firm, and Société Chérifienne Des Pétroles of Morocco decide to join the venture each of the original firms would give up 10 percent of its interest. Seismic work was scheduled to start in midyear.

Société Marocaine de Raffinage of Morocco and Société Nationale Algerienne Sonatrach completed an accord under which the Sidi Kacem and Mohammedia refineries will purchase 2 million tons of crude oil from Algeria during 1969 through 1970.[19]

An extension of 4 years' duration was granted to Société Chérifienne Des Pétroles on two exploration permits.[20] The permits were for Rharb-Prerif covering 371 square miles and Essaouira D with 789 square miles.

Morocco has two refineries: A small plant at Sidi Kacem with annual capacity of about 350,000 tons and a larger installation at Mohammedia with annual output of about 1.25 million tons.[21] All of Morocco's crude production is processed at Sidi Kacem with crude imported from Algeria, Nigeria, and the U.S.S.R. processed at both plants. New units being added at Mohammedia will increase output of bitumen, lubricants, and jet fuel. This expansion will make Morocco self-sufficient in petroleum refinery products and provide a surplus for export.

[19] Chronique de Mines et de La Recherche Miniere, No. 378, Nov.–Dec. 1968, p. 8.
[20] Petroleum Times. V. 72, No. 1848, June 7, 1968, p. 834.
[21] Petroleum Information Bureau (London). Oil—Africa. February 1969, p. 1.

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The Mineral Industry of the Netherlands

By Columbus R. Gentile [1]

The mineral industry of the Netherlands registered a substantial gain in 1968, with particularly large increases reflected in the petrochemical, natural gas, petroleum refining, and aluminum sectors, and impressive, though somewhat lesser gains, in the iron and steel, lead, and zinc components. Offsetting the higher level of activity in these sectors was the decline in production of tin metal and the slowdown in the coal and coke industry as more producing units suspended or cutback operations.

The national economy, as a whole, expanded rapidly in 1968 with industrial production rising 11 percent, a growth rate somewhat higher than anticipated and double that attained in 1967. The main stimuli to expansion of economic activity were the sharp rise in exports and growth in investments. Worker productivity rose 6.5 percent or approximately the same as wages, and consumer prices and cost of living advanced 3.7 percent and 3 percent, respectively, closely approximating increases in 1967.

Crude oil output declined for the third consecutive year as onshore and offshore drilling indicated no new significant finds. In contrast, expansion of petroleum refining, pipeline, storage, and distribution facilities continued at a rapid rate, along with growth of chemical and petrochemical installations and associated units.

Exploration for oil and gas in the Netherlands sector of the North Sea was initiated by several groups soon after concessions were granted in March 1968. By yearend only two strikes of gas were reported, neither of which had been evaluated for commercial prospects. Meanwhile natural gas production from onshore installations doubled for the fourth consecutive year and domestic consumption and exports both attained record levels as production and distribution facilities were expanded to meet rapidly rising demand. At the same time more onshore concession areas were opened to successful applicants.

Aluminum capacity at Netherlands lone smelter at Delfzijl more than doubled in 1968 with the completion of a second potline. Work was immediately started on new facilities that will increase capacity to 90,000 tons in 1969. Plans were also announced for construction of a new smelter by Compagnie Péchiney a French concern, with an initial capacity of 75,000 tons annually.

Iron and steel output capacity continued to increase in 1968, as new facilities came on stream, and work on other expansion projects proceeded according to schedule. Plans were also announced for further capacity expansions and the building of new facilities to meet anticipated growth in demand. Development of the Rotterdam port area continued in 1968 as work progressed on expansion and new construction of petroleum refineries, chemical, petrochemical, and industrial plants and associated facilities including pipelines and storage units. Work was also moving ahead on plans for projects designed to accommodate the larger vessels and tankers now in use or under construction, and the improvement of loading facilities at the various harbor piers. Below Rotterdam at Moerdijk construction was started on a new petrochemical complex and the development of port facilities.

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PRODUCTION

Reflecting the growth of the economy, output of most mineral commodities in the Netherlands increased in 1968 with aluminum, natural gas, petroleum products, salt, and fertilizer materials showing the largest gains, and production of tin metal, coal, and coal products the more significant declines.

Aluminum output was up 53 percent in 1968 as new capacity became operative in the third quarter of the year; crude steel and pig iron production each rose about 9 percent; and lead rose 6.2 percent. In contrast, output of tin metal fell an estimated 43 percent.

In the case of nonmetals, cement produc-

Table 1.—Netherlands: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum, metal (primary)	1	----------	20	32	49
Cadmium, metal e metric tons	105	90	100	r 107	107
Iron and steel:					
Sinter	2,787	3,212	3,025	3,271	3,860
Pig iron (including blast furnace ferroalloys)	1,948	2,364	2,209	r 2,588	2,821
Steel, excludes castings	2,646	3,138	3,256	r 3,402	3,707
Steel, semimanufactures:					
Strip	84	82	74	87	108
Heavy and medium plates and sheets	1,604	1,720	1,764	1,749	2,033
Light sections	68	128	206	295	308
Wire rods	152	158	181	200	266
Tubing	----------	12	32	12	23
Semimanufactures	292	285	343	394	292
Total	2,200	2,385	2,600	2,737	3,030
Lead, metal (primary)	17	15	15	16	17
Tin, metal (primary) thousand long tons	16	18	13	14	8
Zinc, metal (primary)	38	41	41	39	43
NONMETALS					
Cement	2,873	2,973	3,163	3,349	3,436
Fertilizer materials: Manufactured:					
Nitrogenous, N content	480	506	618	r 737	890
Phosphatic, P_2O_5 content	191	200	188	r 206	264
Potassic, K_2O content metric tons	2,500	2,500	r 2,000	588	NA
Salt, all types	1,596	1,707	1,857	1,926	2,414
Sulfur, elemental	29	27	46	43	NA
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	52	62	70	75	77
Coal, anthracite and bituminous	11,480	11,446	10,052	8,065	6,663
Coke, all types	4,623	4,383	3,887	3,332	2,931
Fuel briquets, all grades	1,421	1,395	1,265	1,118	1,054
Gas:					
Manufactured, all types million cubic feet	143,358	135,698	108,775	93,153	87,318
Natural, gross production [1] do	27,015	r 55,514	r 116,395	253,731	514,172
Peat e	400	400	400	400	400
Petroleum:					
Crude oil	2,270	2,395	2,366	2,265	2,145
Refinery products:					
Aviation fuels	976	777	1,289	1,027	1,259
Motor gasoline	2,769	2,746	2,250	2,189	3,648
Solvents	178	207	251	233	
Kerosine	955	1,127	1,075	928	1,172
Residual fuel oil	10,943	12,888	13,413	14,276	16,146
Distillate fuel oil	6,025	6,567	7,837	8,075	9,565
Liquefied petroleum gases	362	396	465	519	528
Lubricants	251	332	338	321	278
Bitumen	681	678	745	673	593
Refinery gases	166	166	118	34	NA

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Converted from Nm^3 (cubic meters at 15° C and 760 mm mercury) at rate of 35.314 cubic feet per cubic meter.

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tion rose 2.6 percent, salt 25.3 percent, and nitrogenous and phosphatic fertilizer 20.8 and 28.2 percent, respectively.

The mineral fuel sector reflected a 5.3-percent decline in the output of crude oil, and a continuation of the downward trend in output of coal, coke, and briquets which decreased by 17, 12, and 6 percent, respectively, as natural gas and petroleum products continued to displace coal in most energy markets. Natural gas production doubled for the fourth consecutive year and output of major refinery products registered sizeable gains, ranging from 13 percent for residual fuel oils to almost 51 percent for motor gasoline (including solvents).

TRADE

Foreign trade of the Netherlands moved toward a more favorable balance in 1968 as exports covered about 90 percent of imports, as compared with 87 percent in the previous year. During 1968 total exports of roughly $8.3 billion were up over 14 percent, while imports rose about 11 percent to nearly $9.3 billion.

For mineral commodities, imports at $2.1 billion exceeded exports ($1.5 billion) by some $600 million in 1968, with imports and exports up 10 percent and 13 percent, respectively, as compared with 1967 levels. A summary of the value of mineral commodity foreign trade and total commodity trade is shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	1,133	6,746
1967	r 1,313	7,281
1968 p	1,484	8,332
Imports:		
1966	1,753	8,011
1967	r 1,909	8,328
1968 p	2,091	9,282

p Preliminary. r Revised.

The most important mineral commodities exported from the Netherlands in 1967, on the basis of value share, were petroleum and its products (33.3 percent), iron and steel (23.2 percent), nonferrous metals (9.8 percent), coal, coke, and briquets (7.6 percent), metalliferous ores and scrap (7.4 percent), and manufactured fertilizers (6.1 percent). Exports of petroleum and products, iron and steel, and metalliferous ores and scrap each rose approximately 16 percent to $434 million, $305 million, and $97 million respectively; and coal and coal products by 2 percent to almost $100 million. Natural gas exports for 1968 amounted to $35.2 million or about 2.5 times the total for 1966, and exports of manufactured fertilizer at nearly $80 million increased 53 percent. On the other hand, nonferrous metal exports in 1967 at $129 million were down slightly from those of the previous year ($130 million).

About 78 percent of Netherland's mineral commodity exports in 1967 moved to Western European countries, principally (52 percent) to European Economic Community (EEC) countries. Major individual export markets, included West Germany (25.4 percent); Belgium-Luxembourg (15.4 percent); United Kingdom (10.7 percent); France (8.2 percent); and Sweden (4.9 percent).

With respect to 1967 imports, petroleum and refinery products were by far the most significant, accounting for over 45 percent of total value of mineral commodity imports. Other major categories included iron and steel (22.5 percent), nonferrous metals (11 percent), and metalliferous ores and scrap (7.5 percent). Imports of petroleum and products in 1967 increased 16 percent to $741 million; metalliferous ores and scrap 14 percent to almost $143 million; and iron and steel 6 percent to $430 million. In contrast, imports of nonferrous metals declined 4 percent to $210 million, and coal, coke, and briquets over 1 percent to $121 million.

West Europe, principally EEC countries, supplied about 54 percent of Netherlands' mineral commodity imports (value basis) in 1967. The more significant individual suppliers were West Germany (23.8 percent), Belgium-Luxembourg (16.3 percent), Kuwait (7.3 percent), United States (5.5 percent), Saudi Arabia and Libya (4.8 percent each), and France 4.7 percent.

The entrepôt trade in crude oil and refined petroleum products in 1967 was up slightly from 1966, with entries in bond

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of 25.4 million tons and withdrawals of 24.1 million tons. Entries of crude in 1967 totaled 15.9 million tons and withdrawals 15.6 million tons. Comparative totals for petroleum products were 9.5 million tons and 8.5 million tons, respectively. Entries of crude in bond exceeded withdrawals by roughly 300,000 tons while the net increase for petroleum products amounted to 1 million tons.

Transit trade in mineral commodities increased significantly in 1967 with the bulk of the tonnage comprised, as in previous years, of metals and metal ores, coal-coke-briquets, fertilizers and fertilizer materials, petroleum and products, and sand-gravel-crushed stone.

Table 2.—Netherlands: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite and alumina	43	40	West Germany 10; Belgium-Luxembourg 5.
Metal including alloys:			
Scrap	11,735	10,216	West Germany 8,474; France 641.
Unwrought	16,156	25,597	Belgium-Luxembourg 12,872; West Germany 7,648.
Semimanufactures	17,463	19,060	West Germany 6,448; Belgium-Luxembourg 3,767.
Bismuth, including alloys, all forms	229	214	West Germany 67; France 48; Italy 30; Belgium-Luxembourg 30.
Cadmium, including alloys, all forms	266	252	West Germany 111; Belgium-Luxembourg 82.
Chromium:			
Chromite	1,713	3,320	West Germany 1,084; Italy 682; Belgium-Luxembourg 581.
Oxides and hydroxides	72	54	West Germany 34.
Cobalt, including alloys, all forms	71	157	France 103; West Germany 16; Japan 15.
Tantalum, including alloys, all forms.	5	4	Belgium-Luxembourg 1; United States 1.
Copper, metal, including alloys:			
Scrap	34,793	34,213	West Germany 19,422; Belgium-Luxembourg 12,396.
Unwrought	9,088	6,265	West Germany 3,117; Italy 1,576.
Semimanufactures	16,059	13,516	West Germany 4,606; United States 3,486.
Gold [1] thousand troy ounces	208	742	West Germany 578; France 136.
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	4	3	West Germany 2.
Roasted pyrite do	190	90	Belgium-Luxembourg 62; West Germany 28.
Metal:			
Scrap do	394	566	West Germany 442; Belgium-Luxembourg 61.
Pig iron and ferroalloys [2] do	100	297	Japan 209; France 26.
Steel, primary forms do	736	816	Spain 263; Belgium-Luxembourg 227.
Semimanufactures:			
Bars, rods, angles, shapes, sections. thousand tons	286	328	West Germany 122; United Kingdom 58.
Universals, plates and sheet do	849	972	West Germany 206; United Kingdom 100.
Hoop and strip do	56	67	West Germany 42; Denmark 6.
Rails and accessories do	28	10	United States 6; West Germany 3.
Wire do	25	27	West Germany 9; Republic of South Africa 4.
Tubes, pipes and fittings do	162	211	Belgium-Luxembourg 85; West Germany 35.
Castings and forgings do	4	4	Sweden 1; West Germany 1.
Lead:			
Oxides	1,503	1,914	Belgium-Luxembourg 1,057; Czechoslovakia 648.
Metal:			
Scrap	4,673	6,650	Belgium-Luxembourg 3,793; West Germany 1,819.
Unwrought	11,611	11,385	West Germany 7,615; Belgium-Luxembourg 891.
Semimanufactures	2,039	2,012	United States 366; West Germany 271.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Magnesium, including alloys, all forms	252	262	West Germany 141; United States 89.
Manganese:			
Ore and concentrate	10,766	18,732	West Germany 5,351; Italy 2,954.
Oxide	1,667	1,718	Belgium-Luxembourg 538; United Kingdom 372.
Mercury—76-pound flasks	638	1,131	West Germany 435; East Germany 145; Rumania 145.
Molybdenum, including alloys, all forms	155	91	West Germany 43; France 10.
Nickel:			
Oxide and hydroxide	10	36	West Germany 31.
Metal, including alloys:			
Scrap	1,290	2,170	United Kingdom 726; West Germany 692.
Unwrought and semimanufactures	765	1,332	West Germany 396; Italy 152.
Platinum-group metals, all forms—troy ounces	27,200	24,434	West Germany 7,877; Belgium-Luxembourg 4,212; France 4,083.
Silver, metal:			
Unwrought—thousand troy ounces	845	1,761	Belgium-Luxembourg 1,137; France 420.
Semimanufactures—do	273	293	Denmark 152; West Germany 55; Belgium-Luxembourg 47.
Tellurium, elemental, and arsenic	------	2	All to West Germany.
Tin:			
Oxide—long tons	5	--------	
Metal including alloys:			
Scrap—do	697	579	United Kingdom 193; West Germany 121.
Semimanufactures—do			
Titanium, dioxide	10,726	9,043	West Germany 2,017; Italy 1,731; France 1,397.
Tungsten:			
Ore and concentrate	92	249	United Kingdom 133; West Germany 80.
Metal including alloys, all forms	221	113	West Germany 67.
Vanadium, ore and concentrate (including molybdenum, etc. n.e.s.).	5,863	10,526	West Germany 2,630; Japan 1,872; Austria 1,505.
Zinc:			
Ore and concentrate	4,443	7,725	Belgium-Luxembourg 6,540.
Oxide	9,621	8,915	West Germany 1,261; Italy 1,246; Belgium-Luxembourg 1,070.
Metal including alloys:			
Scrap	10,325	8,050	France 7,514.
Unwrought	23,235	27,410	West Germany 15,171; Italy 2,060.
Semimanufactures (includes zinc dust)	1,103	1,095	Denmark 505; West Germany 356.
Other:			
Ore and concentrate	32	1	NA.
Ash and residues containing metals:			
Iron and steel—thousand tons	130	156	Belgium-Luxembourg 156.
Lead	2,859	5,460	Belgium-Luxembourg 4,066; West Germany 1,224.
Tin—long tons	NA	806	Spain 447; West Germany 204; United Kingdom 144.
Zinc	9,371	7,824	Belgium-Luxembourg 4,290; West Germany 2,399.
Other	12,525	11,384	West Germany 7,002; Belgium-Luxembourg 1,994; Switzerland 1,141.
Metals including alloys, all forms:			
Metalloids:			
Selenium	4	14	All to Canada.
Silicon	10	39	West Germany 30.
Other	19	NA	
Alkali, alkaline earth and rare earth metals.	------	1	NA.
Oxides of strontium, barium, and magnesium	203	249	Belgium-Luxembourg 186; Jamaica 61.
Metals, including alloys, all forms	661	689	West Germany 195; France 186.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum	4,879	4,968	West Germany 598; France 365; Belgium-Luxembourg 259.
Dust and powder of precious and semiprecious stones—thousand carats	1,079	1,118	West Germany 419; France 211; Italy 210.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Abrasives, natural, n.e.s.—Continued			
Grinding and polishing stones	727	818	West Germany 272; United Kingdom 107; France 103.
Asbestos	15	54	Belgium-Luxembourg 34.
Borates, crude natural	170,289	222,056	West Germany 81,818; United Kingdom 46,150; France 37,892.
Cement	35,942	43,822	West Germany 33,228; Belgium-Luxembourg 10,250.
Chalk	16,867	42,828	Belgium-Luxembourg 42,102.
Clays and clay products:			
Crude clays:			
Kaolin	752	147	West Germany 117; Belgium-Luxembourg 18.
Refractory	1,761	1,835	Sweden 753; Belgium-Luxembourg 297; Denmark 222.
Other—thousand tons	119	86	West Germany 60; Belgium-Luxembourg 23.
Products:			
Refractory including non-clay bricks	7,843	10,421	West Germany 3,060; Belgium-Luxembourg 2,685.
Nonrefractory—thousand tons	528	590	West Germany 452; Belgium-Luxembourg 109.
Diamond, all grades:			
Gem, not set or strung—thousand carats	1,810	1,514	NA.
Industrial—kilograms	20,142	804	Belgium-Luxembourg 487; Switzerland 74.
Diatomite and other infusorial earths	133	271	Belgium-Luxembourg 134; West Germany 54.
Feldspar and fluorspar	558	501	Belgium-Luxembourg 286; Australia 141.
Fertilizer materials:			
Crude: Phosphate rock	557	505	Colombia 297; Kenya 101.
Manufactured:			
Nitrogenous—thousand tons	442	165	United Kingdom 27; Mainland China 16.
Phosphatic:			
Thomas slag	5,248	NA	
Superphosphate and other. thousand tons	290	141	France 46; Italy 4.
Potassic	1,577	1,099	Belgium-Luxembourg 688; Kenya 99.
Other, including mixed—thousand tons	424	524	France 43; Belgium-Luxembourg 20.
Ammonia, anhydrous	38,886	82,999	Belgium-Luxembourg 48,183; West Germany 24,735.
Lime	1,384	3,043	Belgium-Luxembourg 1,450; West Germany 1,381.
Magnesite	28,940	17,999	West Germany 7,377; Belgium-Luxembourg 1,395.
Mica	76	100	Belgium-Luxembourg 72.
Pigments, mineral including processed iron oxides	258	306	Ceylon 97; Indonesia 43; Belgium-Luxembourg 37.
Salt—thousand tons	1,057	1,152	Sweden 325; Finland 134.
Sodium and potassium compounds, n.e.s.: Caustic potash.	45	44	United States 7; Spain 7.
Stone, sand and gravel:			
Dimension stone:			
Unworked:			
Building stone unworked including slate.	3,457	1,856	Belgium-Luxembourg 1,182.
Calcareous, including gypsum and plasters.	297	747	Belgium-Luxembourg 579.
Worked: Building stone worked including slate and natural paving stone.	4,086	9,489	Belgium-Luxembourg 8,572; West Germany 803.
Gravel and crushed rock—thousand tons	2,161	1,283	Belgium-Luxembourg 1,106; West Germany 176.
Quartz and quartzite	4,137	9,334	West Germany 2,819; Belgium-Luxembourg 2,171.
Sand, excluding metal bearing—thousand tons	6,909	6,974	Belgium-Luxembourg 6,364; West Germany 164.
Sulfur:			
Elemental, all forms	50	2,544	Italy 2,213.
Sulfur dioxide	917	916	Belgium-Luxembourg 60.
Sulfuric acid, oleum—thousand tons	100	90	West Germany 22; Belgium-Luxembourg 20.
Talc and steatite	210	142	West Germany 19; Belgium-Luxembourg 11.

See footnotes at end of table.

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Table 2.—Netherlands: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Other nonmetals, n.e.s.—thousand tons	167	169	Belgium-Luxembourg 106; West Germany 45; France 16.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	82	78	Belgium-Luxembourg 57.
Carbon black	60,241	66,394	France 21,344; Sweden 9,325; West Germany 9,301.
Coal and briquets:			
Anthracite and bituminous coal.—thousand tons	1,850	1,935	Belgium-Luxembourg 1,136; France 530.
Briquets of anthracite and bituminous coal.—do	825	743	West Germany 266; Belgium-Luxembourg 265.
Lignite briquets—do	21	12	NA.
Coke and semicoke—do	1,903	1,998	Belgium-Luxembourg 440; West Germany 327.
Gas, hydrocarbon: Natural including liquefied petroleum gas.—do	310	421	Belgium-Luxembourg 129; United Kingdom 105; West Germany 61; France 57.
Hydrogen, helium, and rare gases	498	475	Denmark 137; Belgium-Luxembourg 132.
Petroleum:[3]			
Crude—thousand tons	1	1	All to Belgium-Luxembourg.
Refinery products:			
Gasoline—do	3,733	3,460	Sweden 209; Norway 170.
Kerosine, including jet fuel—do	812	732	United Kingdom 320; West Germany 108.
Distillate fuel oils—do	4,184	4,475	Sweden 773; Belgium-Luxembourg 306.
Residual fuel oils—do	6,976	8,731	Belgium-Luxembourg 581; Sweden 377.
Lubricants—do	323	425	United Kingdom 68; Sweden 41.
Mineral jelly and wax—do	20	29	United Kingdom 9; West Germany 8.
Other:			
Petroleum coke—do	52	8	United States 6; West Germany 1; France 1.
Bituminous mixtures—do	390	318	West Germany 148; Denmark 44; Norway 21.
Mineral tar, and coal, petroleum or gas derived crude chemicals.—do	141	151	West Germany 42; Belgium-Luxembourg 38.

NA Not available.
[1] Excluding gold coin and gold and alloys shipped by post.
[2] Including sponge iron, shot grit, pellets powder, spiegeleisen, and ferromanganese.
[3] Includes bunkers for foreign ships and aircraft. Excludes reexports and bonded storage.

Table 3.—Netherlands: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	35,305	16,539	Greece 14,495; Guyana 1,979.
Alumina	71,875	76,403	Surinam 65,509; West Germany 10,571.
Metal, including alloys:			
Scrap	3,884	4,588	Belgium-Luxembourg 1,623; West Germany 1,054.
Unwrought, including alloys	19,829	19,419	West Germany 4,002; Norway 3,732.
Semimanufactures	34,765	37,105	Belgium-Luxembourg 14,736; West Germany 12,903.
Antimony, including alloys, all forms	276	1,001	United Kingdom 202; Belgium-Luxembourg 183; West Germany 107; Japan 102.
Arsenic, oxides and acids	836	965	Belgium-Luxembourg 818.
Bismuth, including alloys, all forms	245	260	West Germany 62; United Kingdom 60.
Cadmium, including alloys, all forms	261	171	Japan 57; Belgium-Luxembourg 49; U.S.S.R. 20.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Chromium:			
Chromite	3,749	5,952	Republic of South Africa 2,560; Zambia 2,038.
Oxide and hydroxide	657	741	West Germany 466; mainland China 85.
Metal, including alloys, all forms	6	8	France 4; United Kingdom 3.
Cobalt:			
Oxides and hydroxides	280	283	Belgium-Luxembourg 205.
Metal, including alloys, all forms	163	238	United Kingdom 106; Belgium-Luxembourg 98.
Tantalum	8	2	Belgium-Luxembourg 1; United States 1.
Copper, metal including alloys:			
Scrap	8,712	10,785	West Germany 5,281; East Germany 2,293.
Unwrought	31,643	33,619	Belgium-Luxembourg 13,610; West Germany 4,651.
Semimanufactures	60,997	50,057	Belgium-Luxembourg 28,016; West Germany 13,427.
Gold [1] thousand troy ounces	NA	175	West Germany 62; Denmark 62.
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	3,451	3,641	Liberia 948; Brazil 938.
Roasted pyrite	NA	89,650	Belgium-Luxembourg 61,512; West Germany 27,533.
Metal:			
Scrap thousand tons	145	164	Belgium-Luxembourg 89; West Germany 36.
Pig iron and ferroalloys [2] do	98	19	Belgium-Luxembourg 5; West Germany 4.
Ferroalloys, other do	12	10	Norway 5; West Germany 3.
Steel, primary forms do	219	429	Spain 242; West Germany 82.
Semimanufactures:			
Bars, rods, sections do	1,186	1,178	Belgium-Luxembourg 624; West Germany 406.
Universal plates and sheets do	541	548	West Germany 220; Belgium-Luxembourg 208.
Hoop and strip do	196	186	West Germany 112; Belgium-Luxembourg 68.
Rails and accessories do	46	43	West Germany 31; Belgium-Luxembourg 10.
Wire do	58	63	Belgium-Luxembourg 36; West Germany 23.
Tubes, pipes and fittings do	462	575	West Germany 339; France 123.
Castings and forgings do	7	5	Belgium-Luxembourg 2; West Germany 2.
Lead:			
Ore and concentrate	5	11	France 10.
Oxides	8,048	9,164	Belgium-Luxembourg 4,541; West Germany 2,330.
Metals including alloys:			
Scrap	2,977	1,864	West Germany 1,561.
Unwrought	51,798	55,650	Belgium-Luxembourg 16,841; Australia 8,840.
Semimanufactures	3,040	3,252	Belgium-Luxembourg 2,457.
Magnesium, metal including alloys:			
Scrap	90	88	Norway 74.
Unwrought	208	294	U.S.S.R. 197; Norway 80.
Semimanufactures	45	49	Austria 19; France 13.
Manganese:			
Ore and concentrate	27,261	42,771	India 12,364; U.S.S.R. 8,571; Morocco 6,721; Ghana 2,828.
Oxides	635	603	France 208; Belgium-Luxembourg 202.
Mercury 76-pound flasks	3,539	1,334	Spain 609; United States 348.
Molybdenum, including alloys, all forms	92	8	Austria 3.
Nickel:			
Matte, speiss and similar materials	1,616	258	United Kingdom 231.
Metal, including alloys:			
Scrap	1,059	1,351	Norway 488; United Kingdom 370; France 213.
Unwrought	2,040	1,571	United Kingdom 460; France 322; Norway 168.
Semimanufactures	1,922	2,216	West Germany 1,096; United Kingdom 688.
Platinum-group metals thousand troy ounces	58	60	France 18; West Germany 9; United Kingdom 8; U.S.S.R. 6.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—continued			
Silver, including alloys:			
Unwrought—thousand troy ounces	4,317	1,659	United Kingdom 463; Belgium-Luxembourg 413; West Germany 335.
Semimanufactures—do	2,483	2,215	West Germany 838; France 727; United Kingdom 516.
Tellurium, elemental and arsenic	6	9	NA.
Tin:			
Ore and concentrate—long tons	15,880	20,085	Indonesia 16,431; Belgium-Luxembourg 1,198.
Oxide—do	74	96	West Germany 42; Belgium-Luxembourg 40.
Metal, including alloys:			
Scrap and semimanufactures—do	344	362	Belgium-Luxembourg 155; West Germany 122.
Unwrought—do	3,667	6,039	Thailand 3,155; United Kingdom 711; Nigeria 676; West Germany 640.
Titanium, dioxide	1,794	2,531	West Germany 1,446; Italy 550; France 302.
Tungsten:			
Ore and concentrate	438	-------	
Metal, including alloys, all forms	10	NA	
Vanadium, ore and concentrate, including molybdenum.	19,464	16,184	United States 13,284; Australia 1,548.
Zinc:			
Ore and concentrate	85,730	82,533	Canada 30,924; Finland 20,517.
Oxides	1,514	1,688	West Germany 717; Belgium-Luxembourg 699.
Metal, including alloys:			
Scrap	2,029	213	Belgium-Luxembourg 109; West Germany 66.
Unwrought	16,121	16,155	North Korea 6,224; China, mainland 6,325.
Semimanufactures, including dust	6,222	4,183	Belgium-Luxembourg 3,113.
Other:			
Ore and concentrate	8,071	3,705	Republic of South Africa 3,045.
Ash and residues containing nonferrous metals:			
Lead	1,194	465	West Germany 285; Belgium-Luxembourg 140.
Tin—long tons	596	415	West Germany 156; Republic of South Africa 109.
Zinc	25,906	32,188	West Germany 25,825.
Other	42,832	44,124	Canada 26,534; U.S.S.R. 16,175.
Metals, including alloys, all forms:			
Metalloids:			
Selenium	22	18	Canada 16.
Silicon [3]	163	200	Sweden 65; France 52.
Alkali, alkaline-earth, and rare-earth metals.	206	176	West Germany 174.
Oxides of barium, strontium, and magnesium	604	455	West Germany 179; United Kingdom 124; United States 121.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.—thousand tons	392	371	West Germany 351.
Dust and powder of precious and semiprecious stones—thousand carats	1,177	765	Ireland 610; United Kingdom 70.
Grinding and polishing stones	1,707	1,460	West Germany 742; Austria 213; United Kingsdom 176.
Asbestos	17,028	18,088	Canada 7,381; Belgium-Luxembourg 7,058.
Barite and witherite	28,300	21,151	West Germany 20,041; France 419.
Boron materials:			
Crude natural borates	173,644	230,597	United States 224,445; Belgium-Luxembourg 3,658.
Oxide and acid	1,669	1,414	France 800; United States 420.
Cement—thousand tons	2,091	2,169	West Germany 1,013; Belgium-Luxembourg 1,086.
Chalk	92,437	114,656	Belgium-Luxembourg 76,254; France 27,859.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS			
Clays and clay products:			
Crude clays:			
Kaolin—thousand tons	680	134	United Kingdom 111.
Refractory—do		89	West Germany 61; United Kingdom 10.
Other—do		470	West Germany 435.
Products:			
Refractory, including nonclay bricks. do	42	42	West Germany 15; United Kingdom 15.
Nonrefractory—do	184	161	West Germany 73; Belgium-Luxembourg 70.
Cryolite and chiolite	1,558	792	Denmark 791.
Diamond, all grades:			
Gem, not set or strung—thousand carats	1,544	1,647	NA.
Industrial—thousand kilograms	216	46	Brazil 43.
Diatomite and other infusorial earths	8,179	7,501	United States 1,960; Hungary 1,839; Denmark 1,164; France 831.
Feldspar and leucite	26,049	26,531	Norway 11,796; Canada 6.050; West Germany 4,562.
Fertilizer materials:			
Crude:			
Phosphate rock—thousand tons	706	849	Morocco 512; Togo 204.
Potassium salts—do	61	58	France 33; West Germany 25.
Sodium nitrate—do	29	55	All from Chile.
Manufactured:			
Nitrogenous	12	8	West Germany 5; Belgium-Luxembourg 3.
Phosphatic:			
Thomas slag—thousand tons	197	279	Belgium-Luxembourg 158; United States 76.
Other	19	NA	
Potassic—thousand tons	393	421	United States 163; East Germany 95; Belgium-Luxembourg 80.
Other, including mixed	52	66	Belgium-Luxembourg 54.
Ammonia, anhydrous	3,858	2,079	Belgium-Luxembourg 1,481; West Germany 590.
Fluorspar	15,808	19,870	Mainland China 8,142; United Kingdom 4,254; Spain 3,249.
Graphite, natural	246	185	West Germany 64; United Kingdom 40.
Gypsum and plaster—thousand tons	299	229	United Kingdom 169; France 46; Belgium-Luxembourg 14.
Lime—do	636	684	Belgium-Luxembourg 346; West Germany 319.
Magnesite	36,907	22,347	Greece 9,222; India 3,479; Austria 2,880.
Mica:			
Crude, including splittings and waste	821	937	United Kingdom 488; Norway 280.
Worked, including agglomerated splittings	57	54	Switzerland 27.
Pigments, mineral:			
Natural, crude	1,172	1,897	West Germany 1,042; France 425; Austria 260.
Iron oxides, processed	8,842	10,190	West Germany 7,544; Spain 948.
Pyrite—thousand tons	270	90	Cyprus 71; Portugal 13.
Salt	47,574	39,568	West Germany 30,123.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	89,780	58,835	West Germany 46,747; Italy 6,305.
Caustic potash	6,872	4,035	France 1,545; Belgium-Luxembourg 1,500; West Germany 563.
Stone, sand and gravel:			
Dimension stone:			
Slate	28,390	25,871	West Germany 10,465; France 7,711; Norway 6,518.
Other—thousand tons	1,382	1,698	Belgium-Luxembourg 1,266; West Germany 355.
Dolomite—do	382	387	Belgium-Luxembourg 368.
Gravel and crushed rock—do	8,746	10,236	West Germany 7,133; Belgium-Luxembourg 2,144.
Limestone—do	707	766	Belgium-Luxembourg 745.
Quartz and quartzite	48,271	44,936	Belgium-Luxembourg 25,308; Norway 11,823; West Germany 5,986.
Sand, including metal-bearing—thousand tons	4,176	5,113	West Germany 4,565; Belgium-Luxembourg 463.

See footnotes at end of table.

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Table 3.—Netherlands: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967	Principal sources, 1967
NONMETALS—Continued				
Sulfur:				
Elemental	thousand tons	201	282	United States 213; France 67.
Sulfur dioxide	do	408	847	West Germany 828.
Sulfuric acid, oleum	do	71,304	24,435	West Germany 13,207; Belgium-Luxembourg 11,225.
Slag dross and similar waste, not metal bearing:				
From iron and steel manufacture.	thousand tons	1,518	2,175	West Germany 1,109; Belgium-Luxembourg 1,062.
Slag and ash, n.e.s	do	354	411	West Germany 242; Belgium-Luxembourg 169.
MINERAL FUELS AND RELATED MATERIALS				
Asphalt and bitumen, natural		968	1,486	Trinidad and Tobago 699; United States 512; Belgium-Luxembourg 204.
Carbon black (including other black of carbon)		7,521	7,402	West Germany 4,017; France 1,433; United States 986.
Coal and briquets:				
Anthracite and bituminous coal.	thousand tons	6,697	7,039	West Germany 4,377; United States 1,224; Belgium 900.
Briquets of anthracite and bituminous coal.	do	45	25	West Germany 22.
Lignite and lignite briquets	do	248	176	All from West Germany.
Coke and semicoke	do	209	188	West Germany 139.
Gas, hydrocarbon: Natural, including liquefied petroleum gas.	do	121	123	West Germany 108.
Peat	do	95	113	West Germany 112.
Petroleum:[4]				
Crude	do	29,643	31,871	Kuwait 7,937; Libya 5,495; Saudi Arabia 5,395.
Refinery products:				
Gasoline	thousand tons	463	1,038	Netherlands Antilles 299; Belgium-Luxembourg 184; West Germany 141; Bahrain 121.
Kerosine, including jet fuel	do	322	454	Belgium-Luxembourg 300; Italy 63.
Distillate fuel oils	do	1,805	1,854	Italy 541; United Kingdom 212.
Residual fuel oils	do	3,917	4,116	United Kingdom 328; France 243.
Lubricants	do	354	320	Netherlands Antilles 162; Italy 24.
Mineral jelly and wax	do	20	20	West Germany 6; France 4; Indonesia 3.
Other:				
Petroleum coke		99	119	United States 67; West Germany 47.
Bituminous mixtures, n.e.s.	thousand tons	231	310	Belgium-Luxembourg 160; United States 109; West Germany 36.
Mineral tar and coal, petroleum or gas derived crude chemicals.	do	211	268	United States 67; West Germany 52; Belgium-Luxembourg 36.

NA Not available.
[1] Excluding gold coin and gold and alloys shipped by post.
[2] Including sponge iron, shot, grit, pellets, spiegeleisen, and ferromanganese.
[3] At least 99.99 percent pure.
[4] Includes bunkers for Netherlands ships and aircraft; excludes deliveries to bonded storage.

COMMODITY REVIEW

METALS

Aluminum.—In the third quarter of 1968 work was completed on a second potline at the smelting works of Aluminium Delfzijl N.V. (ALDEL) raising total capacity to 72,000 tons, yearly (formerly 32,000 tons). Output of ingots in 1968 totaled 49,000 tons, an increase of 53 percent as compared with the 32,000 tons produced in 1967 when the plant operated at full capacity. Further expansion of production facilities to be completed by the end of 1969 will increase capacity to 90,000 tons yearly, with added expansion planned for subsequent years.

N.V. Billiton Maatschappij (Billiton), a mining and chemical company, and Koninklijke Nederlansche Hoogovens en Staalfabrieken N.V. (Royal Netherlands Blast Furnaces and Steelworks) (Hoogovens), with a two-thirds interest in the aluminum smelter at Delfzijl and the sales

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organization "Alumined," formed a new company (Holland Aluminum N.V.) on January 1, 1969, in which each has a 50-percent share. The integrated company will engage in the production and marketing of aluminum ingots, the supply of necessary raw materials, and the manufacture of aluminum products. Hoogovens is the owner of Aluminium Industries Vaassen, which produces select aluminum products, and has a 50-percent interest in a small foundry, while Billiton operates bauxite mines in Surinam through a subsidiary company, and is also engaged in bauxite exploration in other countries.

Péchiney, a French concern, will begin construction early in 1969 on a 150,000-ton-per-year aluminum smelter and an anode plant at Vlissingen at the mouth of the Schelde in the Netherlands. The new facility when completed will have two potlines each with an annual capacity of 75,000 tons; the first unit is to become operative in 1971 and the second in 1973. Two aluminum processors in the Netherlands (Medal and Hunter Douglas) are expected to participate with Péchiney in this project.

Iron and Steel.—The upward trend in output of the iron and steel industry continued in 1968, as virtually all sectors registered gains over 1967. Production of pig iron and steel ingots each advanced by 9 percent, sinter output rose 2.7 percent, and production of rolled steel increased almost 17 percent. About 63 percent of total crude steel output was produced by the oxygen process. The value of iron and steel product exports rose 7.8 percent in 1968, while the value of imports increased 3.4 percent. Consumption of crude steel, which declined by 4 percent in 1967, was 11 percent higher in the first half of 1968 than for the same period in 1967.

Hoogovens, currently (1968) engaged in a $280 million expansion program that will increase steel output at its Ijmuiden plant to 4 million tons by 1971, announced a new capital expenditure program that will raise annual steel production to 5.3 million tons by 1974. New funds are to be expended mainly for the construction of a seventh blast furnace with a hearth diameter of 11 to 12 meters (36 to 39 feet), a third cold reduction mill with pickling plant, and installation of a 100,000- to 200,000-ton strip galvanizing facility. Scheduled completion date for these projects range from 1972 to 1974. In 1968 work was completed on a second oxygen-blown steel unit and an ore quay that can accommodate 100,000-ton carriers. Meanwhile work is to be completed in 1969 on hot strip mill No. 2, slabbing mill No. 3, and other facilities. The $22 million pelletizing plant under construction is scheduled to be completed in 1970.

Early in 1969 plans were revealed for the construction of two new steel plants in the Netherlands. One, a crude steel plant with an annual capacity of 2.4 million tons, to be built on the Maasvlatkte, off the Hook of Holland, by Hoogovens and the German firm, Hoesch A.G. Each company will have a 40-percent interest in the new plant with the remaining 20 percent to be optioned off to interested Dutch companies. The second plant, also to be built at Maasvlatkte west of Rotterdam, is a joint enterprise of Nederlansche Kabelfabrieken (NKF) of Delft, and Steenkolen Handels of Veereeniging (SHV) of Utrecht in collaboration with Koppers International. The capacity of the new plant has not been indicated, but is believed to be less than the 2.4-million-ton Hoogovens-Hoesch plant.

Tin.—Production of primary tin decreased 43 percent and ore imports declined 49 percent in 1968. Indonesia provided almost 50 percent of total ore imports; most of the remainder came from Congo (Kinshasa) and Chile. Imports and exports of primary and secondary tin metal were down by 16 percent and 22 percent, respectively, while consumption advanced about 8 percent.

Uranium.—Uranium deposits found on the island of Schouwen-Duiveland early in 1969 are under study by scientists of the Institute of Geology and Vening-Meinesz Laboratory of Utrecht to determine feasibility for economic exploitation.

Zinc.—Late in 1968 Koninklijke Zout-Organon (KZO) and Billiton reached agreement for Billiton to take a 50-percent interest in Kempensche Zinkmaatschappij, a wholly owned subsidiary of KZO. The purpose of the joint venture is the construction of a 100,000-ton-per-year electrolytic zinc smelter at Budel to replace the existing plant which produces 40,000 to 45,000 tons of zinc using the thermal

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process. About 200,000 tons of sulfuric acid will be recovered as a byproduct when the new zinc smelter operates at capacity level. Plans call for the completion of construction and start of operations late in 1971 or early 1972 with initial capacity at 60,000 to 70,000 tons yearly.

NONMETALS

Cement.—Cement production rose 2.6 percent in 1968 to over 3.4 million tons, as imports increased 4.3 percent to nearly 2.3 million tons and exports at 26,000 tons fell about 41 percent. During the year cement capacity increased 300,000 tons to over 4.1 million tons.

Netherlands' largest cement producer N.V. Erste Nederlandse Cement Industrie of Maastricht produced about 60 percent of total output in 1968 and for the first time, sales exceeded 2 million tons. Most of the remaining production was from the Ijmuiden plant of Cementfabriek Ijmuiden (CEMPJ) N.V. (over 1 million tons) and the Rozenburg plant of Cementfabriek Rozenburg N.V. (340,000 tons).

Fertilizer.—Production of nitrogenous and phosphatic fertilizers increased 20.8 and 28.2 percent, respectively, in 1968 and output of sulfuric acid (100 percent H_2SO_4) rose almost 18 percent to about 1.4 million tons. Exports of nitrogenous fertilizer and superphosphates declined sharply in 1967 to 165,000 tons (down 63 percent) and 141,000 tons (down 51 percent), respectively. Imports of phosphate rock (849,000 tons) rose over 20 percent in 1967, and those for potassic fertilizer (421,000 tons) were up 7 percent.

Expansion of existing fertilizer plants and the construction of new facilities now underway or planned will raise production capacity to new highs in subsequent years. Major projects under construction or planned include the following:

1. Added facilities that will increase output of fertilizer (NP and NPK compound) by Dutch State Mines (DSM), a government entity, to 300,000 tons yearly by mid-1970. This increase, along with plans for further expansion of urea production, will raise overall fertilizer capacity to 2 million tons per year.

2. Two new plants under construction by Nederlandse Stikstof Maatshappij (NSM), scheduled to come on stream in 1970, will expand urea and ammonia capacity and maintain the company's position as the largest urea producer in the Netherlands. NSM is owned by Montecatini-Edison (69 percent), Imperial Chemical Industries (25 percent), and Lorraine-Escaut group (6 percent).

3. A new ammonia plant with a yearly capacity of 200,000 metric tons to be built at Ijmuiden for N.V. Maatschappij tot Exploitatie van Kooksovengassen (MEKOG), a company owned by Dutch Shell (40 percent), Koninklijke Zout-Organon (40 percent) and Hoogovens (20 percent). The plant, scheduled for completion in mid-1970, will replace older and less efficient units and use Dutch natural gas as feedstock.

4. In addition, a new $70 million fertilizer complex completed at Rotterdam for Esso Chemie N.V., at the close of 1968 is scheduled to produce annually 456,000 tons of ammonia, 350,000 tons of calcium ammonium nitrate, 180,000 tons of urea, and 230,000 tons of nitric acid.

MINERAL FUELS

All sectors of the mineral fuels industries again showed considerable change in 1968 as natural gas continued to provide the bulk of rising domestic energy needs, and made added inroads in coal and petroleum fuel markets. Notable developments of the year included doubling of natural gas production for the fourth consecutive year; completion of the project for conversion of consumer gas burning equipment to permit utilization of natural gas; expansion of natural gas distribution system to reach added consumers in domestic and foreign markets; granting of concessions and permits for exploration and drilling in offshore and onshore areas; growth of petroleum refinery capacity and construction of additional crude and product pipelines and other associated facilities, including expansion of major port areas; and further shutdown of indigenous coal producing and coking capacity.

Coal.—The downward trend in coal, coke, and briquet output persisted in 1968 as more productive capacity was shut down or curtailed in an effort to bring levels of domestic production more in line with dwindling demand. Coal output declined 17 percent in 1968 to roughly 6.7 million tons and production of coal briquets and

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coke decreased 6 percent and 12 percent, respectively. At yearend 1968 producer coal stocks amounted to 700,000 tons, a decline of 500,000 tons as compared with the close of 1967.

Reductions in coal production stem from Government policy placing increased reliance on natural gas and petroleum products to meet rising energy requirements, with nuclear power to play an increasingly important role as new plants are constructed and become operative. Planned cutbacks in coal production to 5.6 million tons by 1970 will likely be attained before the target date.

Coal imports at 7.5 million tons in 1968 were up some 7 percent from those of the previous year, but coke and coal briquet imports were below the 1967 level. West Germany (68 percent), United States (14 percent), and the United Kingdom were the major suppliers. West Germany and the United Kingdom increased their share of the Netherlands' coal market, whereas the U.S. share declined from 17 percent in 1967 to 14 percent in 1968. In contrast, coal exports remained at the 1967 level of slightly less than 2 million tons, while coal briquet and coke exports declined 7 percent and 25 percent, respectively.

The problem of unemployed coal miners remains less serious in the Netherlands than in most other countries, because of the success of programs for retraining displaced workers and government incentives to attract industry to areas affected by coal mine closures. DSM is considering the construction, together with Shell, of an oil refinery in South Limburg. DSM, whose coal mines once provided most of the national coal output, has suspended or reduced production of coal at several mines and no longer produces coke or coke oven gas. DSM is also a significant participant in the chemical and petrochemical industries, and has a 40 percent interest in the Groningen natural gas field (see Petroleum and Natural Gas section).

Meanwhile, subsidy payments to remaining producing coal mines continue to assure an orderly reduction in coal output, while separation pay, bonus payments, and accelerated pension payments help to tide over redundant workers.

Petroleum and Natural Gas.—The opening of the Netherlands portion of the North Sea Continental Shelf to exploration for oil gas in March 1968 led to immediate drilling activity by several of the 18 corporate groups granted licenses. By yearend 1968, 10 sites had been drilled with only two, yet unevaluated, strikes of natural gas reported. Both strikes were made by Nederlandse Aardolie Maatschappij (NAM, 50/50 Shell and Esso) in an area northwest of the Dutch naval port of Den Helder in Noord Holland province. Meanwhile, onshore concessions and exploration licenses were granted to several groups, including for the first time, groups other than NAM. In granting licenses to other companies, the Government ended criticism of NAM's monopoly position, for several years a subject of considerable controversy. NAM holds the concession for the exploration, development, and production of natural gas resources in the province of Groningen and carries out operations for a partnership in which NAM and DSM share cost and proceeds 60 percent and 40 percent, respectively. The new groups granted concessions include Mobil, Chevron Texaco, and the French Petroland Group. Mobil (33⅓ percent) and NAM (66⅔ percent) have been jointly awarded the Noord-Friesland concession covering the northern part of the Friesland mainland, the Waddenzee and Ameland Islands, and part of Terschelling Island, a concession area covering 1,593 square kilometers in which DSM will have a 40-percent share in the gas produced. The Petroland group has been awarded a 614-square-kilometer area around Leeuwarden, and Chevron/Texaco a 211-square-kilometer area near Oudega-Akkrium.

The problem of market participation by the new groups was resolved when Nederlandse Gasunie N.V. (50 percent Government—10 percent direct and 40 percent DSM—and 50 percent Shell-Esso), the sole distributor of natural gas to internal markets and for export, agreed to exchange a specified volume of gas produced by the Petroland group for an equivalent volume of gas to be exported to France through the Dutch export feeder system.

West Germany's claim to the International Court of Justice (ICJ) for a bigger share of the Continental Shelf was upheld in a decision of the Court issued early in 1969. The ICJ ruled the equidistance principle of delimitation did not apply in this case and recommended nego-

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tiations between Netherlands, Denmark, and West Germany be resumed to resolve differences.

Petroleum.—Domestic crude oil productions declined about 5 percent to slightly over 2.1 million tons in 1968, equivalent to about 8 percent of inland consumption of oil products. Crude output continued to represent a diminishing proportion of inland consumption, which rose by 5.6 percent in 1968. Despite the rise in consumption, the share of total energy provided by oil products declined owing to the more rapid increase in use of indigenous gas. No significant new oil discoveries were reported in 1968 on either the mainland or Netherlands Continental Shelf, and by yearend, prospects for major finds remained unfavorable.

Refinery throughout at roughly 39.7 million tons in 1968 rose 12.6 percent above the level for 1967, as refinery capacity increased to 42–43 million tons by yearend 1968. Added refinery capacity under construction or planned will raise total capacity to 66–67 million tons by yearend 1969 and help to meet rising demand for oil products in the home market, for vessel bunkering, and export to foreign distributors and consumers. Refinery expansion programs were well underway at the Chevron, Shell, and Esso plants in the Rotterdam area that will add 485,000 barrels per day or over 24 million tons of new capacity. The Esso plant was 40 percent complete by yearend 1968. Completion of work on the fifth distillation unit of the Shell Pernis refinery will increase capacity to 500,000 barrels per day by yearend 1969. In preparation for this expansion new storage tanks were built at Europoort facilities, raising capacity to 15 million barrels, and new pipelines were constructed to connect the tank farm to refinery. In January 1968, an explosion temporarily closed the refinery for approximately 2 months.

The first crude oil refinery to be built in Netherlands, outside the Rotterdam area, was officially opened at Amsterdam by Mobil Oil N.V. in September 1968. The 75,000-barrel-per-day unit is supplied with crude oil via a 50-mile, 26-inch pipeline from Europoort (Rotterdam) to Amsterdam. The pipeline has an ultimate capacity of 20 million tons yearly, although initial refinery requirements are 4 million tons per year.

Plans have been submitted for approval to the Ministry of Economic Affairs for construction of a petroleum refinery on a 45-hectare tract near Born and Urmonds in the western mining district of the province of Limburg. The refinery, a joint venture of Royal Dutch Shell and DSM, would have an annual output capacity of 3 million tons, largely for distribution to DSM chemical plants in Limburg Province. Crude oil would be supplied via the Rotterdam-Rhine pipeline.

Late in 1968 the Belgian Government approved plans for the construction of a 62-mile, 30-inch crude oil pipeline from the Rotterdam port area to Antwerp. A joint venture of British Petroleum Belgium, Petrofina, and Esso Belgium, the pipeline will be capable of moving 20 to 30 million tons of crude oil annually, cost an estimated $20 million, and be completed in late 1970 or early 1971.

In 1968 work was completed on a new 106-mile, 36-inch crude oil pipeline (Rotterdam-Rhine pipeline) between Europoort and Venlo. The pipeline has a capacity of 550,000 barrels per day, and replaces the original 24-inch crude line which has been converted to product service. It is now possible to move products by pipeline from the Shell Pernis (Rotterdam) refinery to Ludwigshafen in West Germany.

Besides expansion of oil refinery and pipeline capacity, there has been a tremendous growth of chemical and petrochemical industries in the Netherlands, largely in the Rotterdam area. The heavy concentration of plants in this area stems mainly from the availability of raw materials from the petroleum refinery complex, availability of natural gas by pipeline from fields in eastern part of Netherlands, port facilities capable of handling large-sized tankers, and proximity to major European markets.

The Dutch chemical and petrochemical industry, the 12th largest in the world, increased output by some 25 percent in 1968, with added expansion anticipated in 1969. The large number of new plants under construction or planned assure continued growth of the industry in the years ahead. Some, but by no means all, of the major petrochemical projects are: 1) the $55 million Gulf complex under construction near its refinery in Europoort, 2) Shell Nederland Chemie, NV, plant at Moerdijk about 20 miles south of the Shell refinery in the Rotterdam area, 3) the 300,000-ton

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ethylene plant to be constructed by DSM at Geleen, and 4) The Dow Chemical Company complex at Terneuzen. Units of the Gulf facilities to become operational by 1970 or 1971 include an ethylene plant with an annual capacity of 300,000 tons, a 100,000-ton polyethylene unit, and 150,000-ton cumene plant. Total investment in the Shell complex is estimated at $168 to $252 million, over a period of 10 to 15 years, with the first facility to become operative in 1973. The DSM plant, estimated at $27.6 million, is scheduled to be completed by 1970 or 1971. The Dow Chemical Company units scheduled for completion late in 1969 include an ethylene plant and polyethylene facility, having annual capacities of 400,000 tons and 60,000 tons, respectively.

Natural Gas.—Production of natural gas doubled for the fourth consecutive year in 1968 reaching a new national high of 14,560 million cubic meters. About 14,300 million cubic meters were produced from the Groningen concession and 260 million cubic meters from other fields. Sales in the domestic market rose some 60 percent to 9.6 billion cubic meters in 1968 and exports at 4.3 billion cubic meters were almost four times the level for the previous year. Total sales of natural gas are expected to rise to 21.5 billion cubic meters in 1969, including 7 billion cubic meters for the export market.

The program for conversion of consumer appliances from manufactured to natural gas was completed in December 1968, and both the mainline and regional distribution grid were expanded during the year. At yearend 1968 Gasunie's pipeline network included 1,570 kilometers of main feeder lines, and over 5,000 kilometers of regional distribution lines. Added expansion of the pipeline grid is underway or planned to keep pace with anticipated growth in natural gas demand in domestic and export markets. The program includes a 62-mile, 36-inch Gasunie pipeline from Angerlo to Hilvarenbeek to the Belgium border, a 7-mile, 36-inch Gasunie pipeline from Angerlo to the German border, a 58-mile, 36-inch gasline from Schijndel to Sanderbout to be completed in the fall of 1969, and 139 miles of other gas pipelines ranging from 4 inches to 18 inches in diameter. In addition, the first stage of a giant 22-unit compressor station under construction at Ommen is due to become operative in 1969, with completion of the entire project scheduled for 1972. Plans also call for construction of added compressor complexes at Ravenstein, Wierengsmeer, and Oldeboorn.

Gasunie is responsible for all transmission of natural gas in the Netherlands, including delivery to border points for export to Belgium, France, and West Germany. Gasunie estimates total gas sales will rise to about 60 billion cubic meters by 1975. In order to cope with this volume, three more trunklines will have to be constructed, from the Groningen gasfield southward, and the 36-inch line across Friesland westward will have to be doubled from 1973 onwards. This program will require an investment of some $550 million.

Drilling activity in new concessions on the mainland and in the Netherland Continental Shelf is expected to add significantly to proven reserves of natural gas currently estimated at close to 2,000 billion cubic meters (70,628 billion cubic feet).

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The Mineral Industry of New Zealand

By John A. Stock [1]

In 1968, the value of New Zealand's mineral production, in terms of U.S. dollars, was $50.99 million,[2] a decrease of 13 percent from 1967. However, this decrease reflects currency devaluation rather than a downturn in production inasmuch as the value of minerals produced, in New Zealand dollars, increased by 7.5 percent in 1968.

The combined value of metals and fuels produced during the year declined by NZ$0.2 million whereas nonmetals increased by about NZ$2.1 million. Nonmetals represented about two-thirds of the total mineral production value; the increase was mainly due to a greater output of sand, rock, and gravel. Value of total mineral production by year is shown in the following tabulation:

Year	Percent			Total value, million dollars [1]
	Metals	Nonmetals	Fuels	
1950	10.8	22.5	66.7	26.07
1955	2.3	54.8	42.9	44.07
1960	2.2	55.2	42.6	55.33
1965	.7	66.4	32.9	65.78
1966	.5	68.0	31.5	69.52
1967	1.0	67.7	31.3	58.89
1968	.8	67.6	31.6	50.99

[1] Exclusive of cement, manufactured fertilizers, and products of the New Zealand Refining Co. Ltd. at Whangarei. Value for 1968 converted at devalued rate.

The value of New Zealand's mineral production was about 1.1 percent of its gross national product (GNP) estimated at $4,659 million in 1968. This is a decrease of about 0.2 percent from 1967 levels. Employment in the mineral industries for recent years is shown below:

	1964	1965	1966	1967	1968
Metals, including gold	98	160	77	101	137
Nonmetals	3,885	4,136	3,623	3,685	4,005
Coal	3,631	3,447	3,359	3,279	3,045
Petroleum prospecting	157	46	65	51	78
Total	7,771	7,789	7,124	7,116	7,260

In recent years, interest in exploration and development of mineral deposits, and development of allied industries has been stimulated by an unfavorable balance of trade, demands for greater industrialization, and some successful mineral finds. At year-end 1968, progress had been made in the establishment of New Zealand's first primary steelplant and an aluminum smelter. Despite a small increase in value of exports, an increasing deficit in mineral trade exists. More than half the value of exports was provided by petroleum products. Kauri gum, a fossilized tree resin unique to New

[1] Mining engineer, Division of International Activities.

[2] New Zealand adopted decimal currency on July 10, 1967, on the basis of NZ£1 equals NZ$2 at the existing exchange rate of NZ£1 equals US$2.781. On Nov. 21, 1967, the New Zealand dollar was devalued bringing the exchange rate to about US$1.12. Unless otherwise indicated, values herein are in U.S. dollars converted from New Zealand dollars at the rate of NZ$1 equals US$1.3905 up through fiscal year 1966–67 and at NZ$1 equals US$1.12 through calendar year 1968.

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Zealand, is exported in small amounts for use in lacquers and varnishes.

The outlook for 1969 is for extensive exploration of New Zealand's known deposits of nickel, sulfur, clays, gold, silver, copper, ilmenite, scheelite, uranium, zinc, molybdenum, lead, and possible sources of petroleum and natural gas. The greatest potential seems to be in the development of the beach sands on the west coast of South Island, the bentonite in Canterbury, the scheelite in the central Otago district, the base metals on the Coromandel Peninsula, and the various offshore oil and gas sites. Prospecting permits have already been obtained by the Broken Hill Pty. Co. Ltd. for base metal search in the Westport area, by Mitsui Mining and Smelting Co. Ltd. for the Colville area of the Coromandel Peninsula, by Lime and Marble Ltd. for the Karamea area, and by Kennecott Copper Corp. for South Island areas. The Marcona Corp. of San Francisco through Adaras Developments Ltd. have rights to explore the reserves of iron sands in a strip on the Taranaki coastline, and Helpet Mining Pty. Ltd. have begun test drilling for scheelite and gold in the central Otago district, South Island. Uranium Valley Ltd. and Buller Uranium Ltd. made plans in late 1968 to do underground uranium prospecting north of Greymouth.

The outlook for 1969 also includes possible changes in taxation. The Mineral Resources Committee has proposed tax incentives which will be considered at New Zealand's National Development Conference in 1969. This proposal recommends that mineral and petroleum producing companies be exempt from income tax until gross revenue from sales exceeds accumulated development and operating costs. They would then be taxed at two-thirds the rate applied to companies not producing minerals or petroleum.

PRODUCTION

The production of metallic minerals was somewhat lower in 1968 than in 1967. Although silver output increased from zero to 3,854 ounces, gold output declined about 19 percent to 8,626 ounces during the year. The downtrend in coal output, begun in 1965, continued with 2,260,000 tons for 1968, representing an annual decrease of 6 percent. Conversely, output of refinery products increased about 11 percent to 21,647,000 barrels. Only in the nonmetallics was there a general increase as a result of significant outputs in sand, rock, and gravel, and in manufactured fertilizers.

Table 1.—New Zealand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Copper ore, gross weight	736	144	-------	152	51
Gold, troy ounces	8,948	12,136	8,965	10,708	8,626
Iron ore, gross weight	2,591	2,272	2,666	2,616	3,339
Silver, troy ounces	141	55	2	-------	3,854
Tungsten ore, gross weight	5	-------	3	16	19
NONMETALS					
Cement, hydraulic	787,800	841,844	878,000	818,856	•764,000
Clays:					
Bentonite	1,835	2,973	2,455	3,102	3,163
Fire clay	304,221	360,145	305,612	286,406	258,759
Kaolin (including china clay)	5,961	7,541	8,561	7,784	4,729
Diatomite	1,706	1,757	4,735	1,431	2,066
Dolomite	9,311	7,677	13,464	8,443	8,246
Fertilizer materials: Manufactured: Phosphatic, thousand tons	1,795	1,968	1,953	1,593	1,776
Kauri gum	38	41	49	25	•26
Magnesite	613	850	566	577	805
Perlite	929	1,142	1,045	1,072	1,870
Pumice	20,847	109,594	18,829	16,403	16,577
Quartz: Glass sand	43,945	75,425	92,419	80,412	84,008
Salt	21,674	84,718	36,019	56,086	56,000
Serpentine, thousand tons	137	140	141	90	88

See footnotes at end of table.

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Table 1.—New Zealand: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS—Continued					
Stone:					
Dimension stone	20,887	4,376	9,697	35,148	25,458
Limestone:					
Agricultural and industrial—thousand tons	1,247	1,163	1,156	1,040	980
For cement—do	1,362	1,498	1,700	1,519	1,425
Sand, rock, and gravel—do	19,900	25,568	28,963	24,196	25,810
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—thousand tons	(1)	(1)	(1)	(1)	(1)
Bituminous—do	693	674	642	594	581
Subbituminous—do	2,071	1,867	1,826	1,648	1,507
Lignite—do	159	160	168	169	172
Coke, all types—do	86	75	73	61	e 61
Fuel briquets, all grades—do	15	18	19	20	18
Gas: Natural, gross production—million cubic feet	5	5	4	4	3
Natural gas liquids—thousand 42-gallon barrels	4	(1)	NA	-------	-------
Petroleum:					
Crude—do	4	5	4	3	2
Refinery products: [2]					
Gasoline—do	2,094	8,253	9,625	8,818	9,825
Distillate fuel oil—do	833	3,378	3,467	7,377	8,531
Residual fuel oil—do	1,179	4,893	4,150	836	832
Other—do	48	279	1,565	590	579
Refinery fuel and loss—do	249	609	1,618	1,882	1,880
Total—do	4,403	17,412	20,425	19,503	21,647

e Estimate. NA Not available. p Preliminary.
[1] Less than ½ unit.
[2] Estimates based on latest available data.

TRADE

New Zealand's exports of mineral commodities during fiscal year 1966–67 were valued at $11.8 million and imports of minerals were valued at $249.8 million; annual increases of about 1 percent and 2.3 percent, respectively.

The trend in value and balance of trade for the fiscal years ending June 1966 and June 1967 was as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965–66	11.7	1,052.4
1966–67	11.8	997.9
Imports:		
1965–66	244.1	1,102.4
1966–67	249.8	1,132.2
Trade balance:		
1965–66	−232.4	−50.0
1966–67	−238.0	−134.3

The highest valued single mineral category exported during fiscal year 1966–67 was petroleum products at $6.4 million, a decline of $0.4 million from that during 1965–66. Nonferrous scrap, residues, and semimanufactures at $3.9 million more than made up the loss in petroleum products by increasing $0.9 million.

The value of total mineral commodity imports during fiscal year 1966–67 was made up of 49.8 percent in metals, 32.5 percent in fuels and related materials, and 17.7 percent in nonmetals. Iron and steel imports ranked first at $86.6 million, a decline of $6.9 million from the 1965–66 level. Among fuels, crude and partly refined petroleum accounted for $48.7 million and refined petroleum products, which included increases in gasoline, kerosine, and distillate fuel oil, totaled $31.9 million. Fertilizers of all types were imported for $27.2 million, an annual increase of $1.4 million.

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Table 2.—New Zealand: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67
METALS		
Aluminum and alloys:		
Scrap	719	576
Unwrought and semimanufactures	153	342
Copper:		
Ore and concentrate	1	-------
Metal and alloys:		
Scrap	1,495	1,561
Unwrought and semimanufactures	2,056	2,907
Gold, refined [2] value	$169,018	$98,742
Iron and steel:		
Scrap	5,065	5,535
Unwrought and semimanufactures	228	558
Lead and its alloys:		
Scrap	1,006	986
Unwrought and semimanufactures	448	250
Metalliferous nonferrous residues [2] value	$279,299	$322,298
Silver and platinum ores [2] value	$80,598	$74,005
Tin and its alloys:		
Scrap long tons	7	2
Unwrought and semimanufactures do	28	22
METALS—Continued		
Zinc:		
Scrap and ash	96	215
Semimanufactures	41	17
NONMETALS		
Asbestos articles and building materials [2] value	$113,084	$170,153
Cement	16	1
Clay and refractory building materials [2] value	$40,216	$47,639
Fertilizer materials:		
Crude	1,444	561
Manufactured	882	657
Kauri gum	42	21
Pumice	885	746
Stone, sand and gravel	125	158
Stone, monumental [2] value	$6,807	$7,878
Other minerals	14	114
MINERAL FUELS AND RELATED MATERIALS		
Coal and briquets	7	8
Coke	12	18
Petroleum products [2] value, thousands	$6,804	$6,384

[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at NZ$1 equals US$1.3905.

Table 3.—New Zealand: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal sources, 1966–67
METALS			
Aluminum:			
Oxides and hydroxides	423	504	Australia 298; West Germany 110.
Metals and alloys:			
Unwrought	8,003	10,069	Canada 7,507; Australia 1,593.
Semimanufactures	2,975	5,712	Canada 4,191.
Antimony, metal [2] value	$87,705	$89,039	Mainland China $24,804; U.S.S.R. $24,542.
Arsenic, oxides and acids	155	162	Sweden 74; mainland China 68.
Chromium oxides and hydroxides	200	131	West Germany 75; United Kingdom 29.
Copper metal, including alloys:			
Unwrought	256	244	United Kingdom 141; Republic of South Africa 103.
Semimanufactures	15,617	12,958	Australia 7,218; United Kingdom 3,248; Canada 2,405.
Gold: Metal, unworked troy ounces	12,270	13,171	Australia 9,109; United Kingdom 2,578.
Iron and steel:			
Pig iron, ferroalloys and similar materials	9,345	8,916	Australia 7,211.
Steel, primary forms	247	69	Australia 31; Austria 17; United Kingdom 14.
Semimanufactures	510,609	479,421	Australia 271,498; United Kingdom 118,581; Japan 72,650.
Lead:			
Oxides	971	882	Australia 705; United Kingdom 154.
Metal, including alloys:			
Unwrought	7,402	5,706	Australia 5,583.
Semimanufactures	57	23	United Kingdom 22.
Magnesium: Metal, unwrought	14	2	All from Republic of South Africa.
Manganese: Oxides	455	497	United States 425; Australia 50.
Mercury 76-pound flasks	131	143	Spain 71; United Kingdom 44; Italy 17.
Nickel, metal including alloys:			
Unwrought	54	47	United Kingdom 44.
Semimanufactures	231	374	Australia 177; United Kingdom 108; Canada 84.

See footnotes at end of table.

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Table 3.—New Zealand: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1965–66	1966–67	Principal sources, 1966–67
METALS—Continued			
Silver: Metal, thousand troy ounces, including alloys.	1,977	1,630	Australia 1,201; United Kingdom 879.
Tin:			
Oxides, long tons	10	11	Australia 5; United Kingdom 3.
Metal, including alloys:			
Unwrought, do	388	389	Malaysia 355.
Semimanufactures, do	16	20	United Kingdom 20.
Titanium: Oxides	1,666	664	Japan 434; Australia 210.
Zinc:			
Oxide	28	18	West Germany 7; United Kingdom 6; Australia 5.
Metal, including alloys:			
Unwrought	4,287	4,047	Australia 4,017.
Semimanufactures	919	800	Australia 561; United Kingdom 198.
NONMETALS			
Asbestos	7,741	8,078	Canada 5,255; Republic of South Africa 2,582.
Barite	1,010	2,303	Australia 1,385; United States 483.
Cement	3,262	2,878	United Kingdom 1,426; Japan 719; Denmark 548.
Chalk	1,382	1,216	France 709; United Kingdom 214; Belgium-Luxembourg 202.
Clays and clay products: Kaolin and refractory clays, crude.	6,308	6,318	United States 3,648; United Kingdom 1,414.
Diatomite and other infusorial earths	797	832	United States 808.
Feldspar, fluorspar and nepheline syenite	1,218	1,683	Sweden 1,156; Norway 248; United Kingdom 215.
Fertilizer materials:			
Crude:			
Nitrogenous	3,986	2,642	Chile 2,228; Belgium-Luxembourg 412.
Phosphatic, thousand tons	1,043	1,068	Nauru 538; United States 198; Australia 165.
Manufactured:			
Phosphatic, including basic slag	15,081	24,446	United States 18,949; Belgium-Luxembourg 10,003.
Potassic	180,205	158,472	Australia 110,450; United States 44,532.
Graphite, natural	91	210	United Kingdom 179; Australia 27.
Gypsum and plasters	111,599	112,700	Australia 111,329; West Germany 990.
Lime	418	292	Mainly from United Kingdom.
Magnesite	284	272	Australia 146; India 84.
Pigments, mineral, including processed iron oxides.	1,983	924	Japan 434; Australia 217; United Kingdom 151.
Salt (excluding brines)	51,861	44,452	United Kingdom 32,770; Australia 7,949.
Stone, sand and gravel:			
Building, dimension stone and slate	988	1,004	Sweden 257; United Kingdom 120; Italy 119.
Sand, gravel and crushed stone	1,266	419	Australia 318; United Kingdom 80.
Quartz and quartzite	1,208	1,864	Belgium-Luxembourg 1,626; Australia 229.
Sulfur: Elemental, all forms	214,948	190,637	United States 110,339; Mexico 49,255; Canada 30,428.
Talc and steatite	1,778	1,415	Australia 1,198.
MINERAL FUELS AND RELATED MATERIALS			
Bitumen, natural	453	358	Trinidad and Tobago 331.
Carbon black	4,220	4,132	Australia 2,071; United States 1,483; United Kingdom 522.
Coal	17,786	39,238	Mainly from Australia.
Coke and briquets	65	61	All from United Kingdom.
Petroleum:			
Crude, thousand tons	1,422	1,553	Kuwait 865; Iran 452.
Partly refined, thousand 42-gallon barrels	9,339	9,664	Kuwait 5,700; Saudi Arabia 1,314.
Refinery products:			
Gasoline, do	882	2,111	Australia 746; Venezuela 483; Iran 256.
Kerosine and jet fuel, do	1,162	1,415	Australia 469; Indonesia 238; Malaysia 194.
Distillate fuel oil, do	687	1,208	Singapore 323; Saudi Arabia 260; Venezuela 247.
Residual fuel oil, do	-------	36	Singapore 32; United States 4.
Lubricants [2], value, thousands	$6,295	$5,727	United States $2,164; Australia $2,152; United Kingdom $1,265.
Other [2], do	$2,029	$2,204	United States $1,063; Australia $281.
Mineral tar from coal, petroleum or gas, thousand 42-gallon barrels	35	30	United States 20; Indonesia 6; United Kingdom 4.

[1] Fiscal period, July 1 through June 30.
[2] Converted from NZ$ at NZ$1 equals US$1.3905.

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COMMODITY REVIEW

METALS

Aluminum.—The year 1968 was a year of decision and first steps in the long negotiated powerplant and aluminum smelter project on South Island.

An agreement reached in mid-1968 to construct the smelter at Bluff was essentially a result of favorable tax concessions made by the Government to the Commonwealth Aluminium Corp. Pty. Ltd. (Comalco) of Australia and its two newly acquired Japanese partners. The concessions, calculated on each company's home tax rate, are to be in effect for 15 years and presumably will provide an incentive for the early expansion of the smelter.

The construction costs for the powerplant ($127 million) will be met by the Government while the smelter will be built by Comalco *et al.* for $101 million. Half the cost of the smelter will be provided by Comalco (equally owned by Kaiser Aluminum and Chemical Corp. of the United States and Conzinc Rio Tinto of Australia Ltd.) and the other half by the Sumitomo Chemical Co. Ltd. and Showa Denko K.K., aluminum refiners in Japan. The companies will share the operation of the smelter through the operating company, Comalco Associated Smelters Ltd.

Initial design capacity of the powerplant and the smelter will be about half of the ultimately proposed capacity. Although additional future uses of power can be foreseen, initially, the feasibilities of the two plants are interdependent. Power output at first is expected to be 400,000 kilowatts; half of this will be available for the smelter and half for the national power grid. Final energy output is planned to reach 700,000 kilowatts. Alumina from Comalco's plant in Gladstone, Australia, will be shipped to Bluff. Smelter output of 70,000 tons of aluminum is expected during the first year after startup (1971); reaching full production of 107,000 tons the next year. Expansion to 214,000 tons is expected some time after the powerplant reaches its ultimate capacity; this capacity will include an excess of 300,000 kilowatts for possible ferroalloy and other industries in the Waitaki Valley development.

Aluminum exports are initially expected to benefit New Zealand by $10 million per year in foreign exchange and rise ultimately to $25 million with expansion of the smelter.

First steps include a tail race tunnel for the Lake Manapouri hydroelectric powerplant completed in October 1968, and a contract to be awarded early in 1969 for the construction of a wharf at Bluff to handle ore carriers and other vessels serving the smelter.

Copper.—By yearend 1968 Conzinc Riotinto Australia Exploration Pty. Ltd. (CRA), was issued a copper prospecting license for the scenic preserves of Coppermine and Whatapuke Islands. Estimates by the Government had indicated ore reserves of the order of 30 million tons on Coppermine, but no estimate was made for Whatapuke. Presumably, CRA carried out a plan of sampling, but later withdrew its prospecting application for Coppermine Island as deposits were shown to be small, and because of opposition from conservationists.

CRA has also completed an investigation of copper mineralization on the Murimoto No. 2, Maori land block near the North Cape scenic reserve.

Rediscovery has been made of a copper lode on Mount Baldy near Murchison, South Island, after having been lost as a result of a 1929 earthquake.

Gold and Silver.—Overseas and New Zealand interests were investigating large, low-grade gold areas of Westland and Otago Provinces. Large scale operation using earth moving equipment is expected to make the project economically feasible.

A subsidiary of South Island Gold (Australia) Ltd. is scheduled to work the gold-bearing gravels of the Kawarau and Shotover Rivers on South Island.

Interest has been shown in examining the feasibility of reopening the old Waintu gold mine near Reefton, South Island. The mine had reportedly produced a highly payable ore prior to its closing in 1951.

A newly registered Auckland company, the Consolidated Silver Mining Company of New Zealand Ltd., has raised $448,000 and proposes to increase this capital to $2.2 million to open up old silver mines in the Maratoto Valley near Waihi, North Island, as well as to expand prospecting activities. A treatment mill was scheduled for construction during mid-1968. In one

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mine, the old Silver Queen, considerable reserves of silver have been indicated. It is expected that by late 1969 preparatory work will have been completed and some gold, lead, zinc, and copper concentrate will be produced.

Iron and Steel.—As scheduled, the construction of the Glenbrook works of New Zealand Steel Ltd. at Waiuku has progressed toward limited production. In October 1968, a successful test was made of the rolling section in the new galvanizing plant. Although the works eventually will utilize the large iron sand reserves at Waikato Head, the first products, in November 1968, were galvanized sheet made from imported cold-rolled steel coil. Installation and operation of Glenbrook's two 16-foot electric arc furnaces and a continuous casting machine are scheduled for May 1969, and completion of the Stelco-Lurgi direct reduction plant is anticipated for about July 1969. The New Zealand steel industry also consists of Pacific Steel Ltd., and GKN Steel Company (New Zealand) Ltd., both located at Otahuhu near Auckland. Pacific Steel Ltd., has been expanding its rolling facilities and is installing a wire rodmill with the expectation of receiving steel billets from the Glenbrook Works by 1970. Presumably GKN will receive wire rod from Pacific along with imports of steel rod from Australia and the United Kingdom for use in its wire drawing mill. Demand for steel in New Zealand has been estimated to increase to 660,000 tons annually by 1970, and by the same year the Glenbrook Works' output is scheduled to be 190,000 tons of primary steel.

Titanium.—Investigations have continued into the ilmenite-bearing beach sands in the Westport area of South Island. The major companies presently interested in these deposits are reported to be Buller Minerals Ltd. (subsidiary of Lime and Marble Ltd.), and Rutile and Zircon Mines (Newcastle) Ltd. These companies have acquired licenses covering large acreages in previous years and have set up laboratories for sampling and separation testing. Prior samplings have inferred that coastal beaches contain from 4.3 to 10.9 million tons of ilmenite and 0.4 million tons of zircon. Carpenteria Exploration Ltd. of Australia (a subsidiary of Mount Isa Mines) plans to set up a titanium production plant on the west coast of South Island in 1969.

Tungsten.—As a result of improved tungsten prices, interest has recently been shown in scheelite deposits near Glenorchy, Otago, South Island. Scheelite mineralization has been known in the area for over 100 years, but only for a relatively few years has it been recognized as an area of extensive mineralization worthy of more than small scale operations. In 1968, Australian Consolidated Industries Ltd. purchased mining rights on the Mount Alaska-Black Peak area east of Glenorchy and intends to carry out a major exploration program. Recent geological examinations have been aided greatly by exposed outcrops and suggests that very few of the many formations have ever been prospected or worked. It is presumed that more than 100,000 tons of scheelite could be recovered at Glenorchy, a considerable addition to world production.

NONMETALS

Bentonite and Other Clays.—Bentonite production from the new plant of Canterbury Bentonite Ltd., at a rate of 25,000 tons per year began at yearend 1968. The company is a subsidiary of Lime & Marble Ltd. Raw material for the plant came from deposits at Coalgate, South Island where measured reserves amount to 12 million tons with a minimum additional 8 million tons indicated. Stripping of overburden has exposed seams of about 60 meters thick. Overseas industry has shown interest in the quality of this bentonite. The several grades produced can be used for pelletizing the iron sands of the Glenbrook steel plant, drilling muds, bonding foundry sands, emulsion suspensions, and fillers.

A new kaolin (china clay) processing industry has been started by New Zealand China Clays Ltd. near Kerikeri, Northland, North Island. Government approval of the industry requires a price and quality comparable to that for imported clays.

Salt.—Demand for salt in New Zealand is estimated at 70,000 tons per year, and is expected to double in 10 years. Present production by Dominion Salt Ltd. at Grassmere is about 55,000 tons of solar salt per year. Investigations of new sites for expanding the solar salt industry have been made; however, membrane processes for the concentration of brine from sea water may be considered before further extension of solar methods.

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Sulfur.—Cyminex Corporation (a subsidiary of American Cyanamid Co.) has completed preliminary drilling on a volcanic sulfur deposit near Taupo, North Island. The samples average 20 percent sulfur and the deposit is estimated to contain about 6 million tons of sulfur. Possible markets are a number of nearby fertilizer manufacturers. Mining and metallurgical feasibility studies are being done in New Zealand, Australia, and the United States, but will not be completed until the end of 1969. The option with the property owner, the Taupo Quarries, has been extended until the studies are completed.

MINERAL FUELS

Coal.—Following the established trend of closing down uneconomical coal producing and processing facilities under State control, the State mines, Dobson and Dauntless, on the west coast of South Island were closed after many years of operating losses. It is also anticipated that the Glen Afton Collieries Ltd. mine owned by the New Zealand Dairy Co. will become exhausted and closed down in 1969. The Ngakawau coal briquetting plant, built in 1965 to utilize large excesses of slack coal, is expected to close soon because of poor performance and uneconomical operation.

Petroleum and Natural Gas.—During 1968 oil exploration activity was largely confined to areas of the Continental Shelf. The Minister of Mines approved an offshore prospecting license along the Lord Howe Rise to J. H. Whitney and Co., the first beyond the 200-fathom depth. Mississippi Oil New Zealand Exploration Pty. is planning on using a radar technique involving three shore stations for accurate positioning when they begin offshore seismic exploration between Moeraki and Invercargill on the southeast coast of the South Island in March 1969. Offshore exploration will continue from Dunedin to the West Cape during 1969.

Esso Exploration and Production (New Zealand) Ltd. drilled the first New Zealand offshore well, Moa 1, followed by Moa 1B in late 1968 off the coast of New Plymouth, North Island. Both wildcat wells were dry holes and were abandoned at over 3,000 meters depth. After this, Esso suspended drilling operations. Shell-British Petroleum (BP)-Todd Oil Service did no onshore work in 1968, but drilled their first offshore well, Maui 1. This well, situated in 110 meters of water and 53 kilometers west-southwest of Opunake, bottomed at 3,500 meters and became the first offshore oil discovery in New Zealand. The strongly flowing oil was sealed off until tests can be made on the oil. Five additional wells may be drilled to outline the structure and to estimate the presence of marketable quantities of oil. By late 1968, New Zealand Aquitaine Petroleum Ltd., under a farmout, had completed 1,100 line-miles of seismic survey of Tasman Petroleum Ltd.'s concessions between Tasman Bay and Taranaki Bight. Tasman plans to drill a well in this area by late 1970. Magellan Petroleum has offshore permits to prospect 3 million hectares on the coast of the North Island near Auckland.

On the North Island Newbold Oil Prospecting Co. obtained gas showings at a Rangitaiki well site near Taupo in mid-1968. The Australian Oil Corporation drilled Blackwater No. 1 well in the Murchison area of South Island and obtained promising traces of oil and gas. Blackwater No. 2 is scheduled for drilling nearby in early 1969. Other companies interested in the Murchison area are Downer and Co. Ltd., and the International Energy Corp. of Texas. In the Wekaweka Valley, Coromandel Peninsula, New Zealand Petroleum Exploration Ltd. encountered geothermal activity and a bed of heavy boulders during the drilling of an exploratory well. The hole was abandoned and a second well, the Wekaweka No. 1, drilled nearby ultimately passed through hydrocarbon bearing sands, and bottomed at 1,273 meters. Austral Oil Co. Inc. of Texas and David C. Bintliff Interests are also interested in the Wekaweka area.

Egmont Oil Wells Ltd. at New Plymouth produced about 2,000 barrels of crude oil during 1968 and converted this to about an equal quantity of gasoline, kerosine, and fuel oils valued at $6,412. The Marsden Point refinery at Whangarei, owned 60 percent by Shell, Mobil, Caltex, and BP, and 40 percent by the local company, Europa, and private individuals, had a decrease in profits of about $2 million in 1968.

The exploitation of the natural gas of the Kapuni field near Taranaki, North Island, has begun with the start of con-

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struction of pipelines and a treatment plant. Contracts have been awarded to the Scientific Design Plants Ltd. for a $3.6 million plant to remove impurities from the gas, and to the Fletcher Construction Co. of New Zealand to install a 668-kilometer pipeline of 8⅝-inch diameter at a cost of $8.7 million. Both these projects are being built for the Natural Gas Corp. of New Zealand, a Government body set up to purchase, market, and transport the gas. The owner of the gas, Shell-BP-Todd, is also having a 6-inch 53-kilometer pipeline laid by the Fletcher company between Kapuni and the port at New Plymouth. This line will carry about 3,500 barrels of gas condensate daily, to be shipped to the refinery near Whangarei. Completion of the main pipeline is now expected by October 1969, but gas will probably not be available to consumers before February 1970. The Natural Gas Corp. is studying the possibility of meeting additional consumer demands as well as the feasibility of extracting propane and butane for separate commercial marketing. Plans have been made to drill two more exploratory gas wells off the Taranaki coast in 114 meters of water.

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The Mineral Industry of Nigeria

By David A. Carleton[1]

The mineral industry of Nigeria has been unfavorably affected by the civil war resulting from the secession, in 1967, of the former Eastern Region (Republic of Biafra) from the Federal Military Government of Nigeria. Mineral commodities most adversely affected were lead and zinc, kaolin (clay), coal, petroleum, and natural gas. The normal development of other mineral commodities has been hindered by shortage of foreign exchange, displaced labor, transport delays, and power shortages. In addition to internal problems, columbite production has declined because of a softening price structure resulting from world marketing conditions.

Despite disruptions in production and distribution particularly in the war affected areas, and the slowdown in foreign capital inflows, the performance of the economy in 1968 was not drastically impaired. Production of many commodities was at reasonable levels, the financial sector was able to cope with the wartime conditions, and various fiscal and exchange measures adopted to protect the balance of payments produced a desired effect.[2]

A major fiscal development was the adoption in October 1968 of the Nigerian Companies Decree which requires all foreign registered companies operating in Nigeria to register in Nigeria. The purpose of the new law is logical for a developing country; however, the decree has created problems especially for petroleum companies under U.S. registry operating from branch offices in Nigeria. These companies stand to lose U.S. tax advantages for oil exploration costs (depletion allowances) if required to incorporate in Nigeria. At yearend 1968, Nigerian authorities and company officials were negotiating possible relief for these foreign investors.

Mineral resources are of growing importance to the country's economy because of the rising significance of petroleum. Although petroleum was first discovered in 1956, production and exports did not reach substantial levels until 1965. Mining, including petroleum, which accounted for about 1 percent of the gross domestic product (GDP) in the early 1960's, made up an estimated 5 percent during 1966–67.

PRODUCTION

The production of most mineral commodities, except tin (cassiterite) and the derived tin concentrate and metal, has declined. The interruption of petroleum production and exports from inland fields because of the fighting was perhaps the most drastic because of the bright future petroleum production held for the economy. Offshore production which was not affected continued to increase during the war. At yearend 1968 production from some onshore fields had resumed; however, prewar levels of output were not expected until mid-1969. Because of the political crisis, there are no data on the production and sale of lead and zinc. Previously, all production came from deposits in the former Eastern Region. The small amount of coal produced in 1968 came from workings other than the large operation closed down near Enugu in the former Eastern Region.

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[1] Supervisory foreign mineral specialist (Petroleum), Division of International Activities.

[2] Nigeria Trade Journal. V. 16, Nos. 3 and 4, July–December, 1968, p. 86.

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Table 1.—Nigeria: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Columbite, concentrate	2,377	2,589	2,262	1,955	1,147
Gold, troy ounces	244	80	61	39	215
Lead:					
Concentrate, gross weight	-------	931	2,102	•2,000	-------
Lead content	-------	•700	•1,600	•1,500	-------
Monazite, concentrate	10	r126	7	114	•6
Tantalite, concentrate, kilograms	10,160	13,168	12,192	19,304	11,400
Tin (cassiterite):					
Concentrate, gross weight, long tons	11,787	12,885	12,640	12,620	13,031
Tin content, do	8,721	9,547	9,354	9,340	9,644
Metal, unwrought, do	8,749	9,321	9,869	9,104	9,778
NONMETALS					
Cement, thousand tons	663	983	1,002	784	574
Clay, kaolin	3,000	26,000	20,000	325	237
Limestone, thousand tons	996	1,312	1,098	847	647
Marble	-------	1,137	1,520	1,281	175
Salt	557	904	NA	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, thousand tons	699	740	640	95	•4
Gas, natural:					
Gross, million cubic feet	36,333	79,438	102,677	93,950	51,628
Marketed, do	2,800	8,395	NA	7,023	5,190
Petroleum:					
Crude, thousand 42-gallon barrels	43,997	99,354	152,428	r116,525	51,907
Refinery products:					
Gasoline, motor, do	-------	284	154	1,219	-------
Kerosine, do	-------	187	102	804	-------
Distillate fuel oil, do	-------	341	142	1,314	-------
Residual fuel oil, do	-------	467	194	1,484	-------
Liquefied petroleum gas, do	-------	-------	-------	24	-------
Total	-------	1,279	592	4,845	-------

• Estimate. r Revised. NA Not available.
[1] Excludes mineral production of the Biafrans.

TRADE

Nigeria's foreign trade continued to be depressed because of the country's political crisis. In mid-1968 import restrictions of some commodities were imposed to conserve foreign exchange and to help maintain a positive trade balance. During 12 months following June 1967 foreign exchange assets fell about 20 percent.

Mineral commodities showing the greatest trade change since June 1967 were crude oil and refinery petroleum products. A comparison between the first 9 months of 1968 with those of 1967 showed that the value of crude oil exports declined by $150 million or 78 percent while petroleum imports increased by $18 million or 178 percent.[3] Because of damage to the refinery at Port Harcourt all consumption requirements for refinery petroleum products were met with imports.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	311	793
1967	246	680
1968	•147	591
Imports:		
1966	90	718
1967	91	626
1968	•89	541

• Estimate.

[3] Nigeria Trade Journal. V. 17, No. 1, January–March, 1969, pp. 30–31.

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Table 2.—Nigeria: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Copper, ore, concentrate and matte	NA	26	Belgium-Luxembourg 16; West Germany 10.
Iron and steel, including ferroalloys:			
Scrap	9,672	6,768	Italy 5,954; Netherlands 666.
Semimanufactures	230	20	All to Togo.
Lead ore and concentrate	1,303	928	Netherlands 824.
Nickel, ore and concentrate	907	NA	
Tin:			
Ore and concentrate—long tons	634	9	All to United Kingdom.
Metal and alloys unwrought—do	11,495	10,813	United Kingdom 7,818; Netherlands 1,415.
Zinc, ore and concentrate	1,525	10	All to Spain.
Other nonferrous ores and concentrates [1]	2,566	5,753	United States 3,382; Netherlands 1,354; United Kingdom 602.
Scrap, nonferrous	3,785	2,012	Italy 709; West Germany 487; Netherlands 232.
NONMETALS			
Fertilizer materials, natural	849	120	Togo 69; Dahomey 23.
MINERAL FUELS AND RELATED MATERIALS			
Briquets	1,748	NA	
Coal	244	8	All to Ghana.
Coke and semicoke	11,914	NA	
Petroleum, crude—thousand 42-gallon barrels	143,556	88,736	France 15,673; West Germany 13,623; Netherlands 12,594.
Petroleum refinery products:			
Gasoline—do	r 236	115	UDEAC [2] 60; Niger 20; Cameroon 16.
Kerosine—do	r 37	62	UDEAC [2] 32; Ivory Coast 12; Cameroon 11.
Jet fuel—do	r 25	28	UDEAC [2] 18; ships stores 6.
Distillate fuel oil—do	r 146	139	UDEAC [2] 40; Niger 25; Cameroon 22.
Residual fuel oil—do	r 557	340	United States 144; Japan 111; ships stores 59.
Lubricants—do	r 7	44	Ghana 32; Dahomey 6; Niger 8.
Asphalt—do	r 52	24	Dahomey 23.
Other—do	r 16	NA	
Tar, pitch, and other crude chemicals from coal, oil, and gas distillation	42	17	Dahomey 9; Togo 8.

r Revised. NA Not available.
[1] Includes columbium-tantalum and zirconium ores.
[2] Union Douanière et Economique de l'Afrique Centrale (Central African Customs and Economic Union).

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Table 3.—Nigeria: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum and alloys, metal:		
Unwrought	4	133
Semimanufactures	1,247	1,850
Copper and alloys, metals:		
Unwrought	27	12
Semimanufactures	2,697	2,216
Iron and steel:		
Ore and concentrate	2	------
Metals:		
Pig iron and ferroalloys	461	958
Unwrought	7,056	2,752
Semimanufactures:		
Bars and rods	50,218	32,901
Angles, shapes, sections	36,712	21,175
Plates, sheets, hoop, strip	68,407	84,569
Rails and accessories	1,061	4,994
Tubes, pipes, fittings	108,728	81,894
Other	r 2,340	9,903
Total	267,466	235,436
Lead and alloys, unwrought and semimanufactures	260	464
Nickel and alloys, semimanufactures	136	44
Platinum-group metals, unworked—troy ounces	37,209	22,348
Silver, unworked—do	47,250	7,263
Tin and alloys, unwrought and semimanufactures—long tons	641	187
Zinc and alloys, unwrought and semimanufactures	860	2,540
Metals, n.e.s.:		
Oxides, mainly for paint	589	430
Metals:		
Scrap	r 5,529	1,541
Nonferrous base metals	23	18
Other ores and concentrates	402	114
NONMETALS		
Abrasives, natural	339	188
Asbestos, crude and partly worked	4,594	9,864
Cement—thousand tons	161	45
Clay construction materials—thousand tons	14	10
Fertilizer materials:		
Crude all types	1,401	889
Manufactured:		
Nitrogenous	11,124	29,378
Phosphatic	16,280	28,845
Potassic	1,756	2,220
Mixed	1,347	5,364
Ammonia	251	490
Lime	9,541	9,501
Mica, crude and partly worked	5	9
Salt—thousand tons	126	126
Sodium and potassium compounds, n.e.s. including caustic soda	10,572	8,803
Stone, sand and gravel:		
Dimension stone, worked—thousand tons	5	1
Stone, crushed, sand and gravel—thousand tons	39	35
Grinding stones and wheels	206	131
Sulfur, all forms	75	1,310
Nonmetals, n.e.s.—thousand tons	2	1
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	12,291	76,717
Petroleum refinery products:		
Gasoline—thousand 42-gallon barrels	129	1,068
Kerosine—do	226	438
Jet fuel—do	22	155
Distillate fuel oil—do	128	967
Residual fuel oil—do	19	962
Lubricants—do	262	265
Asphalt and bitumen—thousand 42-gallon barrels	49	4
Other—do	5	------
Tar, pitch, and other crude chemicals from coal, oil, and gas distillation	860	432

r Revised.

COMMODITY REVIEW

METALS

Columbite-Tantalite.—The market for Nigerian columbite and tantalite continued depressed throughout 1968 because of increased competition by the production of pyrochlore from Brazil and Canada. Other factors contributing to the bleak assessment were rising production costs in Nigeria caused by high duties on certain imports, the rise in fuel costs, and delays in shipments caused by the war. In addition the devaluation of the British pound without revision of the Nigerian pound resulted in an immediate drop in proceeds from sales. Most columbite and some tantalite ore are produced in Nigeria in association with tin ore (cassiterite); however, the companies depending primarily on columbite and tantalite production were experiencing the most difficulties. Reportedly, one of these companies is operating at 20 percent of capacity. Most production of columbite in 1968 was limited to byproduct recovery. Four of the 38 columbite producers accounted for about 95 percent of the output. Estimated columbite reserves at March, 31, 1967, were 44,701 long tons proved and 8,923 long tons indicated.[4]

[4] Federal Ministry of Mines and Power. Annual Report—Mines Division 1966–67. Lagos, Nigeria, Aug. 5, 1968, p. 23.

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Although the price for tantalum ores was increasing during 1966–67, efforts to increase production were not successful. In Nigeria tantalite occurs in pegmatites that are scattered and small so that any quick increase in production is unlikely. Gold and Base Metal Mines (Nigeria), Ltd., is the largest of six tantalite ore producers. Another source of tantalum is the tantalum-bearing slags exported by the Makeri Tin Smelting Co., Ltd.

Iron and Steel.—Although a Soviet mineral survey team reported in early 1968 that Nigeria could produce steel at competitive prices, the Government is in no apparent hurry to embark on a development program until the civil war is concluded. Reportedly, the study states that, whereas Nigeria could produce steel by utilizing domestic iron ore exclusively, this would be uneconomical because of the low grade of known iron ore deposits. Similar to previous studies, the Soviet report recommended that higher grade ores be imported and mixed with domestic ores. It is believed that the Soviet team recommended that a simple, less expensive blast furnace rather than a sophisticated, more economical electric process would be better suited to Nigerian manpower conditions. Supposedly, the Nigerian officials considered it unwise to proceed further without a more complete survey of iron ore deposits to determine conclusively that the country does not possess the high-grade ore required for the project. In June 1968 it was reported that a four-man team of Soviet geologists were in Nigeria to "observe all known mineral deposits such as coal and iron ore" in order to determine those which are of primary importance to the economy.

Lead.—Because of the war no data were reported on the production of lead ore in the southeastern part of the country. Both of the major producing areas, Abakaliki and Owerri, were in the fighting zone during most of the year. During the latter part of the 1968 mines in the Owerri section were believed controlled by Federal troops. These latter mines produced about half of the lead output during 1966–67. Presumably, the small unrecorded amounts produced in the Plateau district continued during 1968.

Tin.—Tin ore (cassiterite) is mined throughout the Jos Plateau of central Nigeria by 101 companies, syndicates, and private individuals which in 1967 had title to 3,505 mining leases covering 257,427 acres. Sixteen of these operators account for most of the acreage and 80 percent of the production. Amalgamated Tin Mines of Nigeria, Ltd., a British firm which is the world's largest private enterprise tin producer, held 23 percent of the acreage in 1967 and accounted for nearly 40 percent of the production in 1968. Nearly all of the ore produced is smelted by the Makeri Tin Smelting Co., Ltd., at Jos in central Nigeria. All of the tin metal produced is exported. Although Jos is not in the war zone, shipments from Jos to the coast have been hampered by a dislocation of rail movements.

Despite the many difficulties confronted by the tin industry, the mining companies did well to increase tin concentrate production from 12,620 long tons in 1967 to 13,031 long tons in 1968. Much of this was accomplished in the face of falling international tin prices. Prices fell from $3,360 per long ton in 1967 to about $3,136 per long ton in September 1968. Because of falling prices, worldwide controls on tin exports were imposed by the International Tin Council on September 18, 1968. These controls which were effective through December 31, 1968, set Nigeria's share at 2,812 long tons (content of ore) which was 103 percent of the estimated production for the last quarter of 1968. These controls helped raise prices to about $3,290 per ton at the end of 1968. Profits in Nigeria were down during the year as many companies reported losses. In general exploration and development costs have been reduced to a minimum and the Government planned to reduce royalty payments. During the year, the Federal Ministry of Mines and Power granted loans to small producers to help step up production.

Nigeria continued seventh in the world in tin (content of ore) production and primary tin metal production. The United Kingdom received 84 percent of its tin metal imports from Nigeria in 1968 and accounted for about two-thirds of Nigeria's tin metal exports in that year.

NONMETALS

Fertilizers.—In an effort to reduce expenditures for fertilizer imports which totaled nearly $3 million in 1967, steps

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are being taken to build Nigeria's first fertilizer plant. A Japanese firm plans to build a $2.8 million plant at a yet undetermined location in the northern section of the country for the production of much-needed superphosphate fertilizer. Work, to begin during 1969, is to be completed in 2 years' time. The new facility should supply about 70 percent of the requirements of the six northern states.

Limestone.—Of Nigeria's six limestone producing companies only three were in production in 1968. They were the West African Portland Cement Co. Ltd. with a cement plant at Ewekoro; the Cement Company of Northern Nigeria, Ltd., with a plant at Sokoto; and the Nigerian Minerals Development Co. Ltd., which supplies small amounts of limestone as flux to the tin smelter at Jos. Limestone production for cement manufacture by the Nigerian Cement Co. Ltd. at Nkalagu near Enugu and by Calabar Cement Co. Ltd. at Calabar was interrupted by the war. The latter plant was originally opened in March 1967. Now that the city of Calabar is in Federal hands, it is possible that this plant may soon resume production. In the Mid-Western State, the new Ukpilla Cement Co. Ltd., was unable to start production as planned because of technical and financial difficulties. Operations at Ewekoro accounted for an estimated 90 percent of limestone production in 1968.

MINERAL FUELS

Petroleum.—During 1968 the petroleum industry began a return to prewar production levels as several onshore oilfields came back onstream starting in October. Until then the only crude oil production during the year came from the offshore fields of the Nigerian Gulf Oil Co. (Gulf), which were outside the fighting areas. At yearend 1968 the only other company in production was the Shell-BP Petroleum Development Company of Nigeria, Ltd. (Shell-BP).

Exploration.—Geologic and geophysical surveying decreased to 63 party-months compared with 112 party-months in 1967. Most of the activity was onshore in the Mid-Western State; however, substantial work was undertaken offshore. The number of exploration wells drilled during 1968 declined to 38 from 78 in 1967 and exploration well footage showed a concomitant reduction to 330,272 from 837,400 in 1967. New field discoveries amounted to 20, most of which were found by Mobil Exploration Nigeria, Inc. (Mobil), in its concession area offshore from the South-Eastern State. Activities at most of the discovery wells were suspended since the immediate purpose of many of the wells was to determine the favorable areas within each concession prior to mandatory partial relinquishment. In November 1968, 10 drilling rigs were active compared with about 25 before the war.

In accordance with their exploration concession contracts, four companies with offshore prospecting areas were required to relinquish 50 percent of their acreage on November 30, 1968. The companies, Gulf, Mobil, Shell-BP, and American Overseas Petroleum, Ltd. (Amoseas), relinquished areas totaling approximately 5,000 square miles. It is expected that these areas will be opened for new bids during 1969.

Production.—Development wells drilled totaled 83 in 1968, compared with 85 the previous year while development well footage was about 867,000 for each year. The success ratio for the development wells drilled in 1968 was 79 percent.

Crude oil production at the beginning of 1968 was about 60,000 barrels daily, all from Gulf's wells offshore from the Mid-Western State. During the year, Gulf completed its Escavos terminal, connected three new fields to its major field, Okan, and increased production to about 180,000 barrels per day by yearend 1968. Gulf plans to bring another field into production in 1969 and has two more waiting for development work.

During the first half of 1968, Federal forces captured the Port Harcourt refinery, Bonny terminal, from which all onshore production was exported, and most of the oil-rich Rivers State. This enabled Shell-BP, the country's major oil company, to enter some of its fields in an effort to renew production. In September the company shipped oil, which had been stored at Bonny terminal since the start of the war, and in October the company resumed production at about 20,000 barrels per day. By the end of 1968 Shell-BP production had reached 270,000 barrels per day, about one-half its prewar level. Part of its production was pumped from fields in the Mid-Western State through the Trans-Niger Pipeline and the remainder ca-

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from fields in the Port Harcourt area which did not sustain heavy damage. None of the fields in the northern part of Rivers State had been recommissioned. Total Nigerian crude oil production reached about 450,000 barrels daily by the end of 1968, or three-fourths of output in June 1967. The following lists 1968 production by company and field in thousands of barrels:

Nigeria Gulf Oil Co.:	
Delta	3,093
Delta South	8,422
Meren	2,610
Okan	21,866
Subtotal	35,991
Shell-BP Petroleum Development Company of Nigeria, Ltd.:	
Afiesere	153
Agbada	1,409
Imo River	441
Kokori	2,598
Korokoro	1,172
Obigbo North	2,044
Olomoro	2,767
Oweh	1,272
Ughelli	914
Umuechem	1,571
Uzere East	704
Uzere West	810
Others	61
Subtotal	15,916
Total	51,907

The only other company producing crude oil before the war, Safrap (Nigeria), Ltd., did not bring its Obagi field into production because of security reasons. Three other companies have onshore fields that will come on stream when conditions permit, and three more companies have offshore fields. Only one of the latter companies (Mobil) plans production for 1969.

Development.—With the discovery since 1965 of substantial quantities of oil in the Mid-Western State, it was decided to build a new export terminal offshore from that State. At yearend 1968 a 50-mile trunkline was being built westward from a junction with the Trans-Niger pipeline near Ughelli to Ogula on the Forcados estuary where a large storage terminal will be built. The 20-mile section from Ughelli to Rapele field, which was nearly completed at yearend 1968, has a diameter of 24 inches. The 30-mile, 28-inch section from Rapele to Ogula, which goes through mangrove swamp, will be laid at the bottom of a prepared canal 40 feet wide and 8 feet deep. From the terminal a 17-mile, 48-inch line will be laid across the estuary to a tanker loading mooring. This latter section will be able initially to move 250,000 barrels daily, rising to 360,000 barrels per day later in 1969. The offshore mooring will be able to load two 200,000-deadweight-ton tankers simultaneously.

Refining.—Although the Port Harcourt refinery was badly damaged by a Federal air attack in early 1968, the Biafrans operated the plant intermittently through March 1968, at which time the refinery was severely damaged by Biafran sabotage prior to their withdrawal from the area. Output data from July 1967, when the Biafrans took over operations, through March 1968 are not available. Damage was heaviest in tank storage, piping, and the central process control system, with the latter completely destroyed. Normal operations are not expected to resume until 1970.

Natural Gas.—About 10 percent of the gas produced was utilized as fuel and 90 percent was flared. The petroleum industry used 311 million cubic feet for its own requirements and 4,879 million cubic feet were sold to the Ughelli powerplant and the Ughelli glass plant. All of the gas consumed came from two wells at the Ughelli East field which also produced 914,000 barrels of natural gas condensate. The percentage of gas utilized was far lower than in the full year prior to June 1967, because large amounts of associated natural gas for which there was no market were flared. It is unlikely that any of the former industrial users of natural gas in the former Eastern Province will be back in operation in 1969.

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The Mineral Industry of Norway

By F. L. Klinger [1]

Stimulated by strong foreign demand, Norway's export-oriented mineral industry was busy in 1968. Production and exports of major commodities such as aluminum, ferroalloys, and iron ore were well above the levels of 1967, while increases of 5 to 10 percent were evident in most other metals and metallic ores as well as in several nonmetals. The construction industry was relatively depressed, but even here the influence of foreign demand was strong enough to increase production and exports of cement. The activity in most branches of the mineral industry was in contrast to nearly static conditions in other Norwegian industries more dependent on domestic demand. The growth of Norway's gross national product (GNP) in 1968 was attributed almost entirely to exports.

Norway became the world's fourth largest producer of aluminum in 1968 and strengthened its position as the leading West European producer of ferroalloys, magnesium, and other electric-furnace products. Production of hydroelectric power increased to 60 billion kilowatt-hours, surpassing the output in Sweden. In other energy-related developments, gas in commercial quantities was discovered in the Norwegian sector of the North Sea, and a new petroleum refinery was completed near Stavanger.

PRODUCTION

Indices of production for different sectors of the mineral industry in the last 3 years were as follows:

	(1961 =100)		
	1966	1967	1968
Mining and quarrying:			
Coal mines	124	124	99
Metal mines	149	186	204
Mineral quarries	117	119	127
Stone, sand and gravel	162	186	160
Mineral processing:			
Primary metals	146	155	176
Nonmetallic mineral manufacturing	126	132	136
Coal and petroleum	113	121	167
All mining and quarrying	144	172	175
All industry	133	140	145

Source: Statistisk Sentralbyrå (Oslo). Statistisk Månedshefte (Monthly Bulletin of Statistics) No. 4, 1969, p. 17.

The strong positive changes in the indices for metal mines and primary metals in 1968 were due mainly to increased output of iron ore, aluminum, and ferroalloys. The smaller gains shown for mineral quarries and nonmetallic mineral manufacturing appeared to be generated by export demand for feldspar, stone, and cement, as domestic construction activity was at a low level and output of sand and gravel was sharply depressed. The decline in coal mining was the result of reduced output at the Spitzbergen mines, Norway's only domestic source of coal. The strong increase in fuels-processing was due to the output from the Sola petroleum refinery, which came on stream early in 1968. The increased output of petroleum products was intended for domestic consumption, rather than for export.

[1] Physical scientist, Division of International Activities.

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Table 1.—Norway: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Alumina •	14,000	16,000	15,000	15,000	17,000
Metal:					
Primary	261,019	279,302	323,692	360,988	470,080
Secondary	7,376	16,515	11,961	14,055	NA
Superpure •	2,900	2,900	2,900	2,900	3,000
Cadmium	113	r 78	r 72	r 84	87
Cobalt	568	823	799	509	645
Copper:					
Mine output, metal content:					
In copper concentrate	7,758	7,863	7,829	r 8,600	9,447
In cupriferous pyrite	7,215	6,905	6,988	r 5,853	7,127
Metal, primary:					
Blister	17,510	20,085	19,922	20,302	23,480
Refined	12,224	14,762	14,663	14,102	18,159
Iron and steel:					
Iron ore and concentrate thousand tons	2,123	2,464	2,451	r 3,285	3,699
Roasted pyrite do	89	85	83	83	• 85
Pig iron do	437	524	630	r 637	680
Ferroalloys:					
Ferrosilicon (45 percent basis) do	225	278	286	r 288	349
Ferromanganese do	76	121	117	135	170
Ferrosilicomanganese do	110	126	121	134	135
Other do	46	41	35	38	47
Total ferroalloys do	457	566	509	595	701
Steel, ingots and castings do	614	676	730	768	824
Semimanufactures:					
Rolled products do	519	561	592	632	NA
Wire, uncoated do	42	43	41	40	NA
Pipe, including cast iron pipe do	55	65	61	NA	NA
Lead, mine output, metal content	3,580	3,502	3,526	3,320	• 3,660
Magnesium metal, primary	20,935	23,904	25,795	30,454	31,340
Molybdenum, mine output, metal content	228	239	227	275	• 250
Nickel:					
Mine output, metal content	--------	--------	--------	151	NA
Metal, primary	30,110	31,835	32,237	r 28,159	32,120
Platinum-group metals (exports) troy ounces	18,583	18,004	14,564	19,901	21,670
Selenium, elemental •	15	15	15	15	18
Silicon, elemental	NA	10,300	12,890	• 15,000	• 20,000
Titanium:					
Ilmenite concentrate	272,023	282,150	369,726	r 425,557	427,360
Dioxide	NA	NA	• 8,000	• 12,000	• 15,000
Vanadium, mine output, metal content •	670	680	660	r 740	850
Zinc:					
Mine output, metal content	12,493	12,937	13,311	12,172	• 11,600
Metal, primary	48,357	52,576	51,120	r 54,801	60,021
NONMETALS					
Cement, hydraulic thousand tons	1,541	1,603	1,827	2,152	2,299
Feldspar:					
Lump	48,237	41,575	53,130	97,938	• 105,000
Ground and other	22,909	22,421	35,010	16,975	NA
Fertilizer materials, manufactured:					
Nitrogen (total) thousand tons	355	382	388	370	459
Nitrogenous:					
Ammonia do	• 400	415	525	575	NA
Fertilizers do	1,422	1,489	1,379	1,077	NA
Phosphatic do	43	41	23	17	NA
Compound and other do	427	457	583	606	NA
Graphite	7,242	8,480	7,943	r 7,630	8,180
Lime (quicklime and hydrated lime)	r 103,864	r 227,404	r 234,279	r 190,992	• 200,000
Mica (exports)	3,978	4,116	4,290	4,484	4,814
Olivine	57,977	87,655	96,717	86,750	• 95,000
Pyrite and pyrrhotite:					
Cupreous	410,775	413,704	403,784	• 350,000	• 380,000
Other	301,507	295,167	273,714	• 286,863	• 307,690
Total	712,282	708,871	677,498	636,863	687,690
Sulfur content	321,807	316,689	302,183	286,707	• 309,460
Quartz and quartzite	450,378	528,977	522,784	414,868	• 510,000

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Table 1.—Norway: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Stone, sand and gravel, n.e.s.:					
Dimension stone:					
Granite	6,644	5,887	5,632	5,887	•8,000
Marble	1,688	750	2,291	•2,500	•2,000
Syenite ("labrador")	39,728	32,289	45,408	40,106	•47,000
Slate—thousand square meters	239	206	382	370	•290
Crushed and broken stone (unground):					
Dolomite	365,153	NA	272,800	340,725	385,430
Limestone—thousand tons	4,091	3,667	4,088	4,212	4,377
Nepheline syenite	30,816	41,017	57,306	65,210	88,000
Other, including gravel—thousand cubic meters	2,684	3,105	4,179	5,087	NA
Sand and gravel—do	3,461	4,360	4,375	4,933	NA
Sulfuric acid (100 percent)	109,607	124,242	139,299	r214,147	261,973
Talc, soapstone and steatite:					
Unground	79,411	•80,000	78,350	79,295	•80,000
Other	76,217	76,982	80,103	r80,885	•80,000
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades—thousand tons	442	426	434	r427	330
Coke:					
Coke-oven—do	108	201	230	302	•300
Gasworks—do	23	23	10	------	------
Gas, manufactured—thousand cubic meters	31,641	31,867	33,403	29,176	29,320
Peat: •					
For agricultural use	9,582	7,627	7,869	7,880	•8,000
For fuel use	2,411	2,187	2,249	3,845	•4,000
Petroleum refinery products: [1]					
Aviation fuel [2]—thousand tons	375	10	13	20	92
Gasoline, motor [2]—do		407	440	369	493
Kerosine—do		------	------	23	80
Distillate fuel oil—do	869	1,009	1,052	1,024	1,489
Residual fuel oil—do	1,517	1,251	1,348	1,381	2,100
Liquefied petroleum gases—do	18	24	26	30	NA
Other, unspecified—do	107	96	92	171	362
Total refinery products—do	2,886	2,797	2,971	3,018	4,616
Total crude oil throughput—do	3,028	2,889	r3,171	3,019	4,996

• Estimate. r Revised. NA Not available.

[1] Source: Organization for Economic Cooperation and Development (OECD) (Paris). Provisional Oil Statistics, 4th quarter, 1968; also Basic Statistics of Energy, 1958–67.

[2] Includes aviation gasoline and jet fuel.

[3] Includes white spirit and S.B.P. liquids.

TRADE

Norway's overall foreign trade continued to show a deficit in 1968, but it was substantially less than in 1967. Part of the improvement was due to trade in mineral commodities, where an export surplus was realized for the first time in many years. The surplus was generated mostly by exports of aluminum, which increased by 125,000 tons over the level of 1967.

Value of total trade and mineral commodity trade for the last 3 years is shown below:

In mineral commodity trade, metals and metallic ores continued to account for nearly 80 percent of the value of exports and 60 percent of the value of imports. The share of fuels in the value of imports remained at about one-third, although

	Value (million dollars) [1]	
	Mineral commodity trade	Total commodity trade [2]
Exports:		
1966	556	1,564
1967	553	1,738
1968	665	1,938
Imports:		
1966	565	2,405
1967	575	2,749
1968	643	2,707

[1] Converted from Norwegian Kroner (NKr) at the rate of NKr 7.14 = US $1.

[2] Including ships.

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imports of crude oil increased by 54 percent in volume and $30 million in value, as compared with 1967 levels. There were also substantial increases in exports of ferroalloys, and in imports of copper-nickel matte and alumina.

The United Kingdom continued to be Norway's principal partner in mineral commodity trade, followed by West Germany, Sweden, and the United States. Exports to these countries in 1968 accounted for 75 percent of the total export value while the same countries supplied 42 percent of the value of imports.

Values of the principal mineral commodities traded in 1967 and 1968 are shown in the following tabulation:

	Value (million dollars)	
	1967	1968
Exports:		
Nonferrous metals: [1]		
Aluminum	161.0	222.1
Nickel	57.0	68.8
Copper	29.4	30.6
Magnesium	17.1	15.8
Zinc	11.1	14.6
Iron and steel:		
Iron ore [2]	18.4	21.0
Ferroalloys	61.9	74.5
Other	59.8	62.4
Fertilizer materials	48.6	52.1
Petroleum products	24.2	28.7
Imports:		
Mineral fuels:		
Solid	20.9	23.0
Liquid	175.8	189.1
Iron and steel [1]	134.9	127.5
Alumina [3]	48.6	62.8
Nickel-copper matte	57.4	91.6
Nonferrous metals	64.1	67.7

[1] Including scrap.
[2] Including roasted pyrite.
[3] Including aluminum hydroxide.
Source: Månedsstatistikk over Utenrikshandelen (Monthly Bulletin of Foreign Trade) (Oslo). V. 55, No. 12, December 1967; V. 56, No. 12, December 1968.

Table 2.—Norway: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum metal, including alloys:			
Scrap	1,850	3,788	West Germany 1,527; Sweden 953.
Unwrought	348,007	314,918	United Kingdom 108,694; West Germany 75,973; United States 52,145.
Semimanufactures	7,668	7,767	Sweden 2,287; Denmark 1,775; United Kingdom 1,205; Finland 824.
Cadmium	70	66	NA.
Cobalt	809	434	NA.
Copper:			
Ore and concentrate	15,348	13,163	West Germany 8,597; Sweden 4,565.
Metal, including alloys:			
Scrap	1,914	2,005	West Germany 867; Belgium-Luxembourg 467; United Kingdom 201.
Unwrought:			
Unrefined	5,108	6,560	West Germany, 13,552; Switzerland 1,818; France 1,448.
Refined	16,967	17,507	
Semimanufactures	5,048	2,989	Sweden 2,148; Denmark 451.
Gold metal, unworked or partly worked. troy ounces	NA	611	NA.
Iron and steel:			
Ore and concentrate thousand tons	1,437	2,506	United Kingdom 453; United States 424; Finland 420.
Roasted pyrite	67,853	123,097	West Germany 67,665; United Kingdom 49,957.
Metal:			
Scrap	15,006	6,379	NA.
Pig iron, including cast iron	183,159	155,346	United Kingdom 68,889; Italy 18,362; West Germany 17,270.
Ferroalloys:			
Ferromanganese	114,265	120,514	West Germany 22,814; Belgium-Luxembourg 21,521; United Kingdom 20,143.

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Table 2.—Norway: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Iron and steel—Continued			
Other	360,964	412,571	United Kingdom 110,583; West Germany 95,409.
Steel, primary forms	112,951	175,273	Netherlands 54,450; Denmark 51,056; United Kingdom 25,764; Spain 18,166.
Semimanufactures:			
Bars, rods, angles, shapes, sections	178,821	186,573	United Kingdom 105,832; Sweden 27,595.
Universals, plates and sheets	57,276	64,274	Sweden 31,778; United Kingdom 17,237.
Hoop and strip	261	366	NA.
Rails and accessories	1,188	138	NA.
Wire	3,939	5,872	Poland 1,640; United Kingdom 977; Greece 886; Portugal 710.
Tubes, pipes and fittings	22,793	21,920	Sweden 8,675; United States 4,451.
Castings and forgings, rough	9,136	6,553	Sweden 5,343; Liberia 460.
Total semimanufactures	273,414	285,696	
Lead:			
Ore and concentrate	7,410	7,118	United Kingdom 5,014; West Germany 2,104.
Metal, including alloys:			
Scrap	2,999	4,015	Denmark 3,215.
Unwrought	586	532	NA.
Semimanufactures	259	188	NA.
Magnesium metal, including alloys, all forms	30,427	30,112	NA.
Manganese ore and concentrate	3,048	2,351	All to United States.
Molybdenum ore and concentrate	433	502	Mainly to Sweden.
Nickel:			
Ore and concentrate	-------	2,318	All to Finland.
Metal, including alloys:			
Scrap	132	85	NA.
Unwrought	30,622	29,213	United States 8,589; Sweden 5,724; West Germany 5,069; United Kingdom 4,497.
Semimanufactures	219	239	Netherlands 71; Italy 51; Sweden 44.
Platinum-group metals and silver:			
Waste and sweepings, kilograms	39,909	56,531	NA.
Metal, including alloys:			
Platinum-group metals, troy ounces	14,564	19,901	NA.
Silver, do	NA	11,960	NA.
Selenium, elemental, value, thousands	$70	$53	NA.
Silicon, elemental	11,310	14,482	NA.
Tin metal, including alloys:			
Scrap, long tons	70	33	NA.
Unwrought, do	239	242	Sweden 209.
Titanium ore and concentrate (ilmenite)	350,045	349,762	NA.
Zinc:			
Ore and concentrate	16,150	15,361	Poland 11,305; West Germany 3,934.
Oxide	223	183	NA.
Metal, including alloys:			
Scrap	618	407	NA.
Unwrought	40,857	37,377	West Germany 13,459; Sweden 8,322; France 4,228.
Semimanufactures	1,714	1,688	Netherlands 481; Denmark 271.
Other:			
Ores and concentrates	3	12	NA.
Ash and residues containing nonferrous metals	31,000	40,728	West Germany 21,445; Sweden 14,217; Netherlands 955.
Oxides, hydroxides, and peroxides of metals, n.e.s.	3,872	2,595	NA.
Base metals, including alloys, all forms	62	227	NA.
NONMETALS			
Abrasives (grinding and polishing wheels and stones)	1,213	1,055	Sweden 223; United Kingdom 81.
Cement	447,571	612,969	United States 190,143; Spain 140,079; Nigeria 61,922; Ivory Coast 61,022.
Clay products:			
Refractory (including nonclay bricks)	11,184	6,131	West Germany 4,664; Sweden 720.
Nonrefractory, value, thousands	$106	$51	NA.

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Table 2.—Norway: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Feldspar	106,649	107,095	NA.
Fertilizer materials:			
Manufactured:			
Nitrogenous—thousand tons	1,176	898	NA.
Phosphatic—do	6	4	NA.
Other—do	297	270	NA.
Ammonia—do	65	92	NA.
Graphite, natural	8,299	7,875	NA.
Lime	2,470	669	NA.
Mica, all forms	4,290	4,484	NA.
Pyrite	554,785	484,361	West Germany 380,018; Sweden 55,425; Denmark 36,994.
Salt	4,191	3,248	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	10,447	5,042	NA.
Caustic potash	NA	24	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	1,084	2,572	NA.
Slate	41,710	47,327	NA.
Other	49,523	50,817	NA.
Worked, all types	3,484	247	NA.
Dolomite	84,287	91,084	NA.
Gravel and crushed rock	435,806	638,334	NA.
Limestone	22,886	14,732	NA.
Quartz and quartzite	9,044	7,359	NA.
Sand, excluding metal bearing	NA	1,756	NA.
Sulfur:			
Elemental	2,086	-------	
Sulfur dioxide	3,291	3,752	NA.
Sulfuric acid	18,421	53,715	United Kingdom 30,824.
Talc, steatite, soapstone, pyrophyllite	74,802	76,109	NA.
Other nonmetals, n.e.s.:			
Slag, dross and similar waste, not metal bearing	2,198	-------	
Oxides and hydroxides of magnesium, strontium, and barium	3,872	12,247	NA.
Other	943	1,049	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	926	1,386	NA.
Coal and coke, including briquets:			
Anthracite and bituminous coal	130,002	140,358	NA.
Coke and semicoke	49,575	48,794	NA.
Gas, hydrocarbon, liquefied petroleum gas	18,560	21,652	NA.
Peat, including peat briquets	NA	78	NA.
Petroleum refinery products:			
Gasoline, including natural	153,598	193,066	NA.
Kerosine and jet fuel	8,516	7,406	NA.
Distillate fuel oil	539,448	975,673	NA.
Residual fuel oil	401,773		
Lubricants	28,363	20,891	Denmark 9,359; Belgium-Luxembourg 5,512; Sweden 4,687.
Bitumen and other	279	344	NA.
Mineral tar and other coal- petroleum-, or gas-derived crude chemicals.	21,527	21,349	NA.

NA Not available.

Table 3.—Norway: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	32,570	34,848	Greece 34,885.
Oxide and hydroxide	614,588	702,091	NA.
Metal, including alloys:			
Scrap	580	299	United Kingdom 232.
Unwrought	9,194	12,897	U.S.S.R. 4,598; Hungary 2,179; East Germany 1,608; Netherlands 1,517.
Semimanufactures	10,735	12,037	Sweden 4,890; United Kingdom 1,915; Switzerland 1,469; Belgium-Luxembourg 1,140.

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Table 3.—Norway: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Antimony metal, including alloys	44	86	NA.
Arsenic trioxide, pentoxide, and acids	70	83	NA.
Asbestos	5,580	5,683	Canada 3,409; U.S.S.R. 1,512.
Chromium:			
Chromite	69,890	63,016	Turkey 40,316; U.S.S.R. 17,465.
Oxide	132	184	NA.
Cobalt:			
Oxide and hydroxide	2	2	NA.
Metal, including alloys, all forms	3	8	NA.
Copper metal including alloys:			
Scrap	-------	3	NA.
Unwrought	5,089	3,986	United States 2,184; Sweden 1,010; United Kingdom 719.
Semimanufactures	23,669	23,128	Sweden 5,710; West Germany 4,638; Belgium-Luxembourg 4,523; Canada 2,300.
Gold metal, worked or partly worked—troy ounces	NA	55,524	NA.
Iron and steel:			
Ore and concentrate	8,658	7,728	NA.
Metal:			
Scrap	39,104	24,021	Denmark 15,871; Sweden 5,265.
Pig iron, ferroalloys, and similar materials	19,809	19,968	Finland 8,437; Sweden 4,553; West Germany 3,186.
Steel, primary forms	70,154	56,698	Netherlands 52,653.
Semimanufactures:			
Bars, rods, angles, shapes, sections	231,363	234,780	France 61,856; West Germany 54,152; Sweden 35,465.
Universals, plates and sheets	453,390	465,625	United Kingdom 113,505; Sweden 95,558; West Germany 92,608.
Hoop and strip	64,740	73,247	Belgium-Luxembourg 41,861; France 9,302; West Germany 7,474.
Rails and accessories	11,529	6,567	United Kingdom 2,524; West Germany 1,962; Austria 1,157.
Wire	11,189	9,024	Belgium-Luxembourg 4,523; Sweden 1,264; United Kingdom 1,165.
Tubes, pipes and fittings	65,680	66,076	West Germany 26,219; United Kingdom 12,049; Sweden 10,745.
Castings and forgings, rough	388	607	United Kingdom 277.
Total semimanufactures	838,279	855,926	
Lead:			
Oxides	1,139	992	NA.
Metal, including alloys:			
Scrap	115	31	NA.
Unwrought	11,387	11,734	Peru 2,997; Denmark 2,620; Republic of South Africa 2,083.
Semimanufactures	1,439	1,063	NA.
Magnesium metal, including alloys, all forms	137	96	NA.
Manganese:			
Ore and concentrate	488,562	534,704	Ghana 273,985; Guyana 70,530; Brazil 46,148.
Oxides	265	221	NA.
Mercury—76 pound flasks	609	609	NA.
Molybdenum metal, including alloys, all forms	8	4	NA.
Nickel:			
Matte, speiss, and similar materials	61,374	52,833	Canada 52,810.
Metal, including alloys:			
Scrap	1,875	190	NA.
Unwrought	188	230	United Kingdom 227.
Semimanufactures	271	350	United Kingdom 130; West Germany 107; Sweden 49.
Platinum-group metals and silver:			
Waste and sweepings—kilograms	NA	70	NA.
Metal, including alloys:			
Platinum-group—troy ounces	3,151	2,701	NA.
Silver—thousand troy ounces	r2,975	3,142	NA.
Tin metal, including alloys:			
Scrap—long tons	94	16	NA.
Unwrought—do	594	571	United Kingdom 272; Netherlands 99; Denmark 91.
Semimanufactures—do	354	422	United Kingdom 344; Netherlands 47.
Titanium:			
Ore and concentrate	286	219	NA.
Dioxide	NA	1,124	NA.
Tungsten metal, including alloys, all forms	1	3	NA.

See footnote at end of table.

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Table 3.—Norway: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Zinc:			
Ore and concentrate	87,087	81,548	Sweden 47,810; Australia 18,684; Canada 15,053.
Oxide	1,130	1,059	NA.
Metal, including alloys:			
Scrap	1,388	1,703	Sweden 803.
Unwrought	1,190	1,597	Poland 1,254.
Semimanufactures	1,937	1,973	France 801; Belgium-Luxembourg 717.
Other:			
Ore and concentrate	234	256	NA.
Ash and residues containing nonferrous metals	255	247	NA.
Oxides, hydroxides and peroxides of metals, n.e.s.	152	307	NA.
Metals, including alloys, all forms:			
Metalloids	12	12	NA.
Alkali, alkaline-earth, and rare-earth metals.	1	33	NA.
Pyrophoric alloys	4	8	NA.
Base metals, including alloys, all forms, n.e.s.	469	286	NA.
NONMETALS			
Abrasives:			
Pumice, emery, natural corundum	398	434	NA.
Grinding and polishing wheels and stones	676	727	NA.
Asbestos	5,580	5,683	Canada 3,409; U.S.S.R. 1,512.
Barite and witherite	1,917	1,187	NA.
Boron materials:			
Crude, natural borates	825	690	NA.
Oxide and acid	158	211	NA.
Cement	7,372	7,055	United Kingdom 2,284.
Chalk	6,688	7,831	NA.
Clay and clay products:			
Crude clays:			
Fuller's earth, dinas, chamotte	2,370	1,971	NA.
Kaolin	71,792	67,751	NA.
Other	35,778	41,979	NA.
Products:			
Refractory (including nonclay bricks)	23,974	36,367	Sweden 11,400; United Kingdom 8,628; Denmark 3,280.
Nonrefractory—value, thousands	$3,619	$3,260	Sweden $843; Denmark $680; Netherlands $480.
Cryolite and chiolite	4,513	4,315	NA.
Diamonds:			
Gem, not set or strung—carats	15,000	10,000	NA.
Industrial—do	5,000	40,000	NA.
Diatomite and other infusorial earths	4,382	5,043	NA.
Feldspar	980	18	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	147	316	NA.
Phosphatic	226,090	238,569	U.S.S.R. 193,737; Morocco 20,972.
Manufactured:			
Nitrogenous	475	316	NA.
Phosphatic	7,832	6,768	Belgium-Luxembourg 5,799.
Potassic	157,608	177,968	Spain 92,779; France 44,848, West Germany 22,667.
Other	97,441	21,638	Netherlands 21, 635.
Ammonia	24,488	5,503	NA.
Fluorspar	2,782	2,421	NA.
Graphite, natural	459	386	NA.
Gypsum and plasters	77,688	96,827	NA.
Lime	14,813	18,941	Denmark 10,855.
Magnesite	3,753	2,348	NA.
Mica, all forms	4,981	4,913	NA.
Pigments, mineral:			
Natural crude	454	387	NA.
Iron oxides, processed	1,572	1,861	NA.
Precious and semiprecious stone, except diamond, including synthetic stone, dust and powder.—kilograms	383	306	NA.
Salt and brine	306,397	268,641	Netherlands 111,102; Spain 58,681; United Kingdom 34,476; West Germany 31,795.

See footnote at end of table.

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Table 3.—Norway: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Sodium and potassium compounds:			
Caustic soda	10,441	18,106	NA.
Caustic potash, sodic and potassic peroxides	1,390	1,478	NA.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	303	286	NA.
Slate	816	1,384	NA.
Other	398	374	NA.
Worked, all types	1,674	792	NA.
Dolomite	4,693	2,977	NA.
Flint	1,358	1,451	NA.
Gravel and crushed rock	3,425	14,900	NA.
Limestone	181,070	224,681	NA.
Quartz and quartzite	14,356	48,039	NA.
Sand, excluding metal bearing	140,408	138,911	NA.
Sulfur:			
Elemental	41,618	37,751	United States 28,779; France 8,421.
Sulfuric acid	19,155	1,436	NA.
Talc, steatite, soapstone, and pyrophyllite	4,889	4,410	NA.
Other nonmetals, n.e.s.:			
Crude	42,070	69,143	West Germany 47,285; France 3,973.
Slag, dross and similar waste, not metal bearing	38,303	43,096	Sweden 26,945.
Oxides and hydroxides of magnesium, strontium, and barium.	152	181	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,633	1,622	NA.
Carbon black and gas carbon	3,088	3,329	NA.
Coal and coke, including briquets:			
Anthracite and bituminous coal	372,067	421,575	United States 227,348; United Kingdom 87,523; Poland 72,539.
Lignite and lignite briquets	NA	143	NA.
Coke and semicoke	741,916	630,931	United Kingdom 455,128; West Germany 71,464.
Gas, hydrocarbon—value, thousands	$27	$4	NA.
Peat, including peat briquets and litter	2,308	2,624	Sweden 2,551.
Petroleum:			
Crude and partly refined—thousand tons	2,934	3,192	Libya 964; Kuwait 398; Saudi Arabia 383.
Refinery products:			
Gasoline (including natural)—thousand tons	511	596	Netherlands 182; United Kingdom 152; France 64.
Kerosine and jet fuel—do	340	325	United Kingdom 164; Netherlands 92.
Distillate fuel oil—do / Residual fuel oil—do	2,929	2,822	United Kingdom 929; Netherlands 840; U.S.S.R. 435.
Lubricants—do	54	55	United Kingdom 28; United States 10; Netherlands 8.
Other, bitumen—do	291	272	NA.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Production and exports of aluminum increased by more than one-third in 1968, compared with those of 1967. This was due mainly to operation of a new smelter at Karmøy, and to expanded production facilities at Sunndalsøra and Mosjøen. The plant at Karmøy, operated by A/S Alnor (owned 51 percent by Norsk Hydro-Elektrisk Kvaelstof A/S (Norsk Hydro) and 49 percent by Harvey Aluminum Co.), had an annual production capacity of 80,000 tons of aluminum and was officially opened in June. At Sunndalsøra, a new potline, having an annual production capacity of 66,000 tons, was completed late in the year by Ardal og Sunndal Verk (ASV). At Mosjøen, an increase of approximately 23,000 tons in smelter capacity was apparently achieved early in 1968, as output of aluminum for the year was close to the planned annual capacity of 86,000 tons. The Mosjøen plant was operated by Mosjøen Aluminium

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A/S (Mosal), owned jointly by the Aluminum Co. of America (Alcoa) and the Norwegian firm, Elektrokemisk A/S (Elkem).

By yearend, total Norwegian capacity was nearly 550,000 tons of aluminum annually. This was expected to increase to more than 700,000 tons by 1972. In 1968, ASV began a $48 million modernization program at Ardal which was designed to increase annual productive capacity by 70,000 tons by the end of 1971. Expansion of capacity at Karmøy, to 120,000 tons annually, was reportedly already underway. At Lista, on the southwest coast midway between Stavanger and Kristiansand, Mosal was building a smelter with an initial capacity of 30,000 tons, scheduled for completion by 1971.

The Norwegian Government, which controlled about 30 percent of domestic production capacity, continued to protest the construction of aluminum smelters in the United Kingdom, on the grounds that investment grants allowed by the British Government for such projects constituted an unfair subsidy which would lead to dislocation of normal trade between the two countries, in violation of Article 13 of the EFTA convention. This was denied by the British Government, which stated that the investment grants were not a special privilege extended to the aluminum industry, and that imports of aluminum from Norway (about 115,000 tons annually) would not be lessened. In a third view, an Elkem official said that new smelters built in the United Kingdom or West Germany did not threaten existing Norwegian industry, but they would reduce marginal profits and would affect plans for establishing new smelters in Norway.

In other developments, both Alcoa and Elkem acquired significant shares in British and Dutch producers of aluminum semimanufactures in 1968. In the United Kingdom, each company purchased 25 percent of the share capital of Imperial Aluminum Co. (IMPALCO) from Imperial Chemical Industries, Ltd. In previous years, IMPALCO has been a large purchaser of aluminum from the Mosjøen smelter, and the company's annual requirements of 30,000 tons will probably now be supplied by Mosal. A similar transaction was concluded with Lips Aluminum N.V., the principal Dutch producer. Elkem's entry into the EEC market area was reported to be the first to be gained by the Norwegian aluminum industry.

By an agreement between ASV and Det Norske Zinkkompani (DNZ), a plant for the production of aluminum fluoride will be constructed in Norway by early 1970. The plant will be located adjacent to DNZ's zinc smelter at Eitrheim and will have a production capacity of 20,000 tons annually. DNZ will supply sulfuric acid and ASV will supply aluminum hydrate and imported fluorspar. DNZ is jointly owned by Boliden AB of Sweden, and Compagnie Royale Asturienne des Mines of Belgium.

Iron Ore.—Production of iron ore reached new records at each of the principal mines in 1968, in response to rising demand from domestic and foreign consumers. As compared with 1967 levels, domestic consumption increased by about 100,000 tons, while exports rose 15 percent to 2.74 million tons. A/S Sydvaranger, the principal producing company, continued to account for about 60 percent of the national output and 85 percent of all exports. The Rana mine of A/S Norsk Jernverk produced 865,000 tons of magnetite and hematite concentrates, while the Fosdalen and Rødsand mines produced 386,000 tons and 162,000 tons, respectively, of magnetite concentrates.

The Sydvaranger Co. expected to produce 2.4 million tons of concentrate in 1969. Most of the planned output was sold in advance, reportedly at prices slightly below those of 1968. The 1969 output was expected to include 200,000 tons of pellets, from the company's 1.2-million-ton-capacity pelletizing plant which was scheduled for completion in September. The plant was being constructed by Fried. Krupp G.m.b.H. of West Germany, and will use the "grate-kiln" pelletizing process developed by the Allis-Chalmers Co. of Milwaukee, Wis.

Ferroalloys.—Most of the increase in output of ferroalloys in 1968 was reportedly due to rising production from plants of the Elkem Co. at Salten (ferrosilicon) and at Porsgrunn (ferromanganese).

In 1968, Elkem was building another furnace at Salten which will increase the works' production capacity for ferrosilicon to 80,000 tons annually in 1970. In eastern Norway, A/S Hafslund had nearly completed construction of a new furnace at

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Skjeberg by yearend. The latter plant will have a production capacity of 35,000 tons of ferrosilicon annually when it reaches full production in early 1969. In other developments, Highveld Steel and Vanadium Corp. Ltd. of South Africa acquired worldwide rights to a Norwegian process for the conversion of vanadium-slag to ferrovanadium. The process was believed to be that developed by Christiania Spigerverk (CS), a privately owned iron and steel firm in Oslo. Bremanger Smelteverk, a subsidiary of CS, produced vanadium-slag for several years before concentrating on production of ferrovanadium in 1967. The company's exports of ferrovanadium increased from 22 tons in 1966, to 640 tons in 1968. The source of vanadium is magnetite concentrate from the Rødsand mine at Nesset.

Exports of ferroalloys in 1968 increased by 118,000 tons compared with those of 1967. Exports of ferrosilicon (45-percent basis) rose to 329,000 tons, or 61,000 tons more than in 1967. Gains of 23,000 tons and 19,000 tons, respectively, were registered in exports of ferromanganese and silicomanganese. Imports of raw materials in 1968 included 650,000 tons of manganese ore, mostly from Ghana, and 70,000 tons of chromite, mostly from Turkey.

Pig Iron, Scrap, and Steel.—The increase in production of pig iron in 1968 was approximately equal to the increase in exports. Imports of scrap were reduced to 13,000 tons. The increase in output of steel was accompanied by a 33,000-ton reduction in net imports as compared with those in 1967. Total imports of steel remained close to 900,000 tons, half of which consisted of plates and sheets.

Magnesium.—Increasing production of magnesium was accompanied in 1968 by a drop in exports of 3,000 tons, compared with 1967. However, Norsk Hydro was again reported to be increasing production capacity to 36,000 tons annually.

Norsk Hydro and Salzdetfurth A.G. of West Germany will be joint partners in construction of a magnesium plant in north Germany. The plant, to be completed by 1971, will have an initial production capacity of 20,000 to 30,000 tons of magnesium and 50,000 to 80,000 tons of chlorine annually. Raw material is expected to be magnesium chloride produced by Great Salt Lake Minerals & Chemicals Corp. (GSLMC) of the United States. The Salzdetfurth firm is in partnership with GSLMC.

Nickel.—Production of 3,159 tons of nickel concentrate, containing 4.78 percent nickel, was reported by A/S Titania at Sokndal in 1967. The source of the concentrate was not identified, but production apparently continued in 1968 and 1,600 tons were exported, presumably to Finland.

Rare-Earth Metals.—Although rare-metals are not produced in Norway, the metals are known to occur in many localities, particularly in southeast Norway in Telemark and adjacent counties. During the last 2 years, geologic and laboratory investigations have been carried out on various deposits by a group of Norwegian mining and metallurgical companies, with the assistance of the Norwegian Scientific Research Council and the Institute for Atomic Energy. A/S Megon, a development company formed by 10 firms, is now evaluating the economic potential of the rare-earth deposits, particularly those containing yttrium and europium.

Titanium.—A/S Titania was increasing production capacity for ilmenite concentrate at Tellnes and Sokndal to 500,000 tons annually. The expansion was scheduled for completion in the fall of 1969. Production capacity in 1968 was 430,000 tons annually.

Exports of concentrate in 1968 totaled 396,000 tons.

NONMETALS

Cement and Other Construction Materials.—Apparent domestic consumption of cement remained stationary in 1968 but exports increased by 227,000 tons compared with those of 1967. Norway was reported to account for 50 percent of all exports of cement from West European countries.

In September, the three Norwegian cement companies announced their decision to merge. The new company, A/S Norcem, will have a total output capacity (including clinker) of about 2.7 million tons annually.

Feldspar.—A large flotation plant, for production of potassic and sodic feldspar and quartz, was completed at Lillesand in mid-1968 by the H.Bjørum company in association with Belgian and West Ger-

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man firms. Initial production capacity of the plant was approximately 50,000 tons of feldspar and 25,000 tons of quartz annually, but production can be easily doubled. Raw materials are quarried from pegmatite dikes which contain proved reserves of about 20 million tons of crude ore. The feldspar products will be marketed under the name "Norfloat."

The producing company, K/S Bjørum-Sibelco-Quarzwerke A/S & Co., is owned 50 percent by H. Bjørum and 25 percent each by Sablières et Carrières Reunies S.A., of Antwerp, and Quarzwerke G.m.b.H. of Cologne. The latter companies own works in most Common Market countries, Spain, and Switzerland and are major suppliers of silica sand to the European glass and ceramic industries.

Pyrite and Sulfur.—The steady decline in production of pyrite since 1963 was reversed in 1968 as production began in midyear at the new Tverfjellet mine near Hjerkinn. The mine was expected to produce about 200,000 tons of pyrite in 1969, enough to compensate for anticipated loss of production at the Stordø, Folldal, and Vigsnes mines and to raise the national output to around 800,000 tons. The old Folldal mine, 30 kilometers east of Hjerkinn, was reportedly exhausted in mid-1968 and the Vigsnes and Stordø mines were expected to close soon.

Pyrite production, by mine, in 1966 and 1967 was as follows:

Mine	Production	
	1966	1967
Løkken	225,551	202,268
Skorovas	165,720	137,450
Sulitjelma	78,492	79,147
Folldal	61,307	67,010
Stordø	60,607	58,705
Killingdal	24,280	28,200
Bleikvassli	28,431	22,574
Fosdalens	15,265	20,159
Vigsnes	16,047	14,262
Bergverkselskapet Nord-Norge A/S	6,798	7,088
Total	677,498	636,868

Output of sulfuric acid was expected to increase in 1969 as most of the pyrite produced at Tverfjellet was scheduled to be used for acid production at Sarpsborg. The increased domestic supply of pyrite appeared responsible for the decline in imports of elemental sulfur, which dropped to 25,000 tons in 1968. At the same time, exports of pyrite rose to 522,000 tons.

MINERAL FUELS

Coal and Coke.—The reduced output of coal in 1968 from Norwegian mines in Spitzbergen, the lowest in 10 years, appeared to be due to marketing problems. Exports to West Germany in 1968 dropped to 67,500 tons, half the level of 1967, and only 60,000 tons were scheduled for export in 1969. Most of the output continued to be shipped to the state-owned coke-works at Mo-i-Rana in north Norway, where it must be blended with higher grade, imported coal in order to make acceptable coke. In 1968, the cokeworks consumed an estimated 240,000 tons of Spitzbergen coal while producing about 300,000 tons of coke and 50,000 tons of by-product ammonia. Approximately 220,000 tons of the Spitzbergen product was scheduled for delivery to Mo-i-Rana in 1969.

Imports of coal and coke increased in 1968, to 537,000 tons and 692,000 tons, respectively.

Oil and Gas Exploration.—A promising gasfield (Cod Field) was discovered 150 miles southwest of Stavanger in 1968 by the Phillips exploration group. The field is close to the offshore boundary between Norway and the United Kingdom. The discovery well was completed on June 15; tests indicated a daily flow of 40 million cubic feet of gas and 2,000 barrels of 51° API gravity condensate. A second well, drilled about 1 mile west, yielded similar flows, while a third well, drilled 2 miles south of the discovery hole, was essentially dry. While the field appeared to contain gas in commercial quantities, difficult marketing problems are faced and an investment of about $200 million may be necessary to build pipeline facilities and bring the field into production. A submarine trench, up to 60 miles wide and 2,500 feet deep, lies between the gasfield and the Norwegian coast. Marketing the gas in Denmark or the United Kingdom would apparently require 150 to 200 miles of pipeline. These problems were still being evaluated and no announcement of gas reserves had been made by yearend. Participants in the discovery group include Phillips Petroleum (37 percent), Petrofina of Belgium (30 percent), Petronord, including Norsk Hydro (20 percent), and

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Agip (Ente Nazionale Idrocarburi) of Italy, (13 percent).

The Phillips group also found gas shows in a hole drilled 19 miles north of the Cod Field, in a separate geologic structure. Eight other companies were active in exploration of the Norwegian offshore areas but no other discoveries were announced.

Exploration of continental-shelf areas between Norway and the Spitzbergen Islands was continued by Norsk Polar Navigasjon A/S, a state-owned company. The company announced plans to begin drilling in the Hornsund area of West Spitzbergen in 1969. Negotiations were underway between the Norwegian and Soviet Governments for establishing a subsea boundary in the Arctic.

Crude Oil Refining.—The new Sola refinery of A/S Norske Shell was inaugurated in April 1968. The plant has a processing capacity of 2 million tons annually and will produce motor gasoline, kerosine and jet fuel, gas and diesel oils, and fuel oil. The completion raised Norwegian processing capacity to 6 million tons annually. The other refinery, south of Oslo at Slagen, is operated by A/S Norske Esso.

Imports of crude oil in 1968 rose to 4,926,000 tons, a 54-percent increase compared with those of 1967. The increased refinery output was largely consumed on the domestic market.

Domestic consumption of petroleum products in the last 2 years is shown in the following tabulation, in thousand metric tons:

	1967	1968
Aviation fuels	153	188
Gasoline	769	807
Kerosine	210	262
Gas/diesel oil	1,850	2,040
Residual fuel oil	2,001	2,067
Other	451	615
Total	5,434	5,979

Source: Organization for Economic Cooperation and Development (OECD) (Paris). Provisional Oil Statistics, 4th Quarter 1968.

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The Mineral Industry of Pakistan

By Charles L. Kimbell [1]

Through 1968, Pakistan continued to be a minor world producer and consumer of mineral commodities, and aside from its extensive, largely undeveloped natural gas reserves, had few known mineral resources of economic significance. Existing mineral industry operations, however, were of some importance to the national economy, considering the sizable trade deficit and large population. More important, plans have been made to provide a greater share of mineral requirements from domestic resources and to obtain as much needed imports as possible in a crude form for processing within Pakistan.

The inadequate mineral resource base problem that faces Pakistan as a whole is even more pronounced when the Eastern area of the country is considered alone. Aside from its roughly 20-percent share of total gas reserves, a preponderance of total kaolin deposits, some marginally economic limestone, and deep-lying coal resources, East Pakistan has no significant known mineral reserve base but is the home of 54 percent of the total 120 million Pakistan population. The distances separating the Eastern and Western areas—almost 1,000 air kilometers across India and about 5,000 kilometers by sea—mitigate against interarea trade, particularly in the case of low unit value commodities such as cement, gypsum, and other construction materials which are among the few mineral items that West Pakistan has in abundance.

Problems of food have been of paramount concern to the Government, as reflected by the massive fertilizer plant construction program (most plants utilizing Pakistan's gas resource) and by Government hopes to desalt extensive areas of the Indus Basin through application of ground gypsum. Government planners have also stressed expansion programs for steel production and oil refining, increased use of natural gas as fuel (where possible replacing imported oil), stepped up search for domestic oil reserves, and alleviation of East Pakistan's acute cement shortage.

Official sources credit crude mineral extraction with a contribution of $35 million [2] to the gross national product of $13,189 million recorded provisionally for the fiscal year ending June 30, 1968 (comparable figures for the previous fiscal year were $34 million and $12,223 million). Value added from mineral processing, including production of steel, fertilizers, cement and refined oil, was clearly much larger than that of crude output. It has been indicated that the nation's petroleum operations will provide almost 14 percent of the total $1,447 million Government revenue in the 1968–69 fiscal year, chiefly from duties and special surcharges. This figure excludes retail sales taxes and duties on petroleum industry equipment.

PRODUCTION

Pakistan's mineral industry as a whole in 1968 surpassed its 1967 performance. Notable gains to new highs were recorded for bentonite, cement, dolomite, phosphate fertilizer, salt, and refined petroleum and natural gas. Crude oil output exceeded that of any past year except 1965. Steel ingot output also apparently established a record although the country's only plant of any consequence failed to approach its 150,000-ton rated annual capacity. Output of bauxite, barite, fire clay, limestone, kaolin,

[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from Pakistan Rupees (PRs) to U.S. dollars at the rate of PRs 4.76 = US$1.00.

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celestite, silica sand, and aragonite also increased compared with that of 1967. Despite pressure to raise output, urea and ammonium sulfate producers did not quite equal their record 1967 performance; production of chromite and soapstone declined slightly while that of gypsum and ocher fell precipitously.

Table 1.—Pakistan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Aluminum, bauxite, gross weight	-------	-------	-------	271	890
Antimony, mine output, metal content [e]	82	61	286	117	84
Chromium, chromite, gross weight	13,508	14,490	27,147	26,373	26,021
Iron and steel:					
Iron ore	4,824	23,429	902	325	76
Steel ingots and castings	11,590	12,169	13,000	[e] 90,000	[e] 100,000
Lead, mine output, metal content [e]	10	5	-------	-------	-------
Manganese ore, gross weight	996	508	126	-------	-------
NONMETALS					
Barite	12,007	7,200	7,824	6,301	10,356
Cement, hydraulic thousand tons	1,546	1,707	[r] 1,846	2,038	2,437
Chalk	-------	-------	457	816	565
Clays:					
Bentonite	293	-------	-------	33	439
Fireclay	[r] 17,062	[r] 15,805	[r] 21,272	18,262	21,204
Fuller's earth	7,000	11,823	5,435	22,575	21,204
Kaolin (china clay)	[r] 971	[r] 1,449	2,758	2,989	3,082
Fertilizer materials, manufactured:					
Nitrogenous, gross weight [2]	[3] 198,342	[3] 158,184	172,682	207,859	188,934
Nitrogenous, nitrogen content [2]	[3] 79,752	[3] 62,389	69,926	85,241	76,219
Phosphatic, gross weight	7,000	9,000	5,873	5,265	18,884
Gypsum, crude thousand tons	195	149	[r] 100	102	46
Magnesite, crude	617	523	[r] 736	2,042	1,631
Mica	4	7	NA	NA	NA
Natron, manufactured (soda ash)	31,300	33,500	28,051	42,958	41,286
Pigments, natural mineral, ochers	159	142	543	1,139	338
Quartz and related materials, silica sand	[r] 26,382	[r] 31,049	36,684	61,444	150,798
Salt:					
Rock thousand tons	197	271	[r] 261	245	327
Marine, evaporated do	194	223	[r] 208	446	571
Total do	391	494	469	691	898
Stone, sand and gravel, not elsewhere specified:					
Dimension stone, calcareous, aragonite and ordinary marble	[r] 9,892	[r] 10,624	[r] 18,163	7,060	14,562
Crushed and broken, limestone and other calcareous thousand tons	[r] 1,931	[r] 1,943	[r] 2,238	1,875	1,968
Other (use not specified), dolomite	720	423	492	630	12,718
Strontium minerals, celestite	269	451	535	379	650
Sulfur	1,500	NA	NA	NA	NA
Talc and related materials (soapstone)	2,559	2,844	3,283	2,649	2,617
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades thousand tons	1,214	1,471	1,358	1,404	[e] 1,500
Gas, natural, sales million cubic feet	59,100	66,194	76,000	83,288	91,525
Natural gas liquids thousand 42-gallon barrels	NA	NA	NA	42	39
Petroleum:					
Crude oil do	3,751	3,992	3,721	3,686	3,832
Refinery products:					
Gasoline do	2,631	2,873	[e] 3,500	2,138	NA
Kerosine and jet fuel do	3,421	3,853	[e] 4,500	4,466	NA
Distillate fuel oil do	3,822	5,440	[e] 4,500	5,043	NA
Residual fuel oil do	7,738	7,580	[e] 8,500	8,496	NA
Lubricants do	97	95	[e] 100	387	NA
Other do	640	92	[e] 500	1,676	NA
Refinery fuel and losses do	917	NA	[e] 700	1,380	NA
Total do	19,266	[4] 20,033	[e] 22,300	23,586	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities listed, Pakistan produces a variety of additional crude construction materials (clays, gravels, sand and stone) as well as steel semimanufactures, but data on output are not available.

[2] Data are for urea and ammonium sulfate; ammonium nitrate is also produced, but data are not available for this commodity for 1966, 1967, and 1968 owing to Pakistan Government restrictions. In the year ending June 30, 1965, output of ammonium nitrate totaled 76,086 tons (gross weight) with a nitrogen content of 26,630 tons. (Comparable figures for year ending June 30, 1964, were 61,289 tons and 21,451 tons, respectively.)

[3] Data for years ending June 30 of year stated.

[4] Total of listed figures only; no allowance has been made for unreported refinery fuels and losses.

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TRADE

During fiscal 1967–68,[3] Pakistan's trade balance improved markedly relative to that of 1966–67, although the country remained a significant net importer as shown in the following tabulation:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total commodity trade	
Exports:			
1966–67	8.6	611.7	1.4
1967–68	13.6	656.2	2.1
Imports:			
1966–67	274.2	1,090.4	25.1
1967–68	210.4	977.5	21.5
Trade balance:			
1966–67	−265.6	−478.7	XX
1967–68	−196.8	−321.3	XX

XX Not applicable.

Mineral commodity exports, although remaining far below mineral import value, increased 58 percent between 1966–67 and 1967–68, primarily as the result of increased refined petroleum shipments as shown in the following tabulation:

Commodity or commodity group	Value (million dollars)	
	1966–67	1967–68
Chromite	0.4	[1] 0.1
Other metallic ores	.5	.2
Metals	.3	.2
Cement	1.1	2.1
Fertilizer materials	2.6	2.9
Salt	.4	.3
Petroleum products	2.1	6.5
Other	1.2	1.3
Total	8.6	13.6

[1] Officially reported figure; other sources indicate a greater quantity and value.

The 23-percent decline in the value of mineral commodity imports was primarily due to reduced iron and steel receipts. Fertilizers and petroleum, the two other major categories, showed little overall change, although the opening of a major new oil refinery was clearly reflected in the sizable shift among oil imports from refinery products to crude oil, as shown in the following tabulation:

Commodity group	Value (million dollars)	
	1966–67	1967–68
Iron and steel	124.0	73.5
Other metals	29.6	23.3
Fertilizers	40.2	39.3
Coal	9.3	10.2
Crude petroleum	24.3	35.3
Refined petroleum	30.2	16.3
Other	16.6	12.5
Total	274.2	210.4

Among mineral imports, quantitative data were available only for refinery products. Total receipts of these for calendar 1968 was of the order of 8.4 million barrels, of which about 40 percent was kerosine and jet fuel, almost 30 percent residual fuel oil and over 20 percent distillate fuel oil. Of the total, East Pakistan received almost 85 percent.

The marked differences in mineral industry activity and mineral material requirements between the two major areas are mirrored in the distribution of mineral commodity trade. In 1967–68 West Pakistan provided 97 percent of mineral commodity exports and received 70 percent of mineral commodity imports (95 percent and 62 percent, respectively, in 1966–67), with the balance going to East Pakistan. While data on distribution of foreign trade between East and West Pakistan do not reflect internal trade between these two areas, such trade in mineral commodities is significant only in the case of a few items; specifically cement, steel, and petroleum products.

[3] July 1 to June 30.

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Table 2.—Pakistan: Exports of selected mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity		1966–67	1967–68
METALS			
Aluminum, metal including alloys, semimanufactures		105	7
Chromium, ores and concentrates		18,499	[2] 2,529
Iron and steel, scrap		7,062	5,013
NONMETALS			
Barite		2,856	3,983
Cement, hydraulic (portland only)		94,410	184,909
Fertilizer materials, nitrogenous (urea only) [3]		----------	8,346
Gypsum		----------	7,875
Salt		126,187	84,716
Stone, sand and gravel, dimension stone [3]		2,517	3,892
MINERAL FUELS AND RELATED MATERIALS			
Coal		----------	450
Petroleum refinery products:[3]			
Gasoline	thousand 42-gallon barrels	28	102
Kerosine and jet fuel	do	13	14
Distillate fuel oil	do	30	134
Residual fuel oil	do	5,722	NA

NA Not available.

[1] Commodities listed had a total value of $4,721,925 in 1966–67 and $9,193,090 in 1967–68; these were about 55 percent and 68 percent, respectively, of total mineral commodity exports for these years. Quantitative data on commodities accounting for the balance of mineral commodity exports were either totaly unavailable or significantly incomplete.

[2] Officially reported figure; other sources indicate larger exports, possibly under barter arrangements.

[3] In addition to commodities listed specifically, additional materials classified under these headings were exported, but only value data are not available.

COMMODITY REVIEW

METALS

Aluminum.—In March it was reported that the Governments of Pakistan and Iran concluded an agreement with Reynolds Aluminum Corp. (United States) for erection of a $45 million, 50,000-ton-per-year aluminum plant at Arak, Iran. Pakistan, with a 10-percent share in the joint venture, will receive 10,000 tons of ingot annually from the plant which is scheduled to begin operating in 1971 on imported alumina.

Bauxite production was reported in Pakistan in 1967 for the first time since 1961 and was continued through 1968, but it was not reported whether this nominal output was for metallurgical testing abroad or for use locally in a nonmetallic application.

Chromite.—Pakistan's only chromite producer, Pakistan Chrome Mines, Ltd., did not achieve its planned 10-percent increase in output to the 30,000-ton level in 1968. Restrictions on movement of Rhodesian chromite apparently improved the competitive position of Pakistan's output, which is mostly metallurgical grade material, stimulating the company to plan for production expansion.

Iron and Steel.—The 1.2-million-ton ingot steel production target set for 1970 in Pakistan's third 5-year plan appeared virtually unattainable at yearend 1968. Feasibility studies were under way for a 500,000-ton-per-year plant at Karachi and a 1-million-ton plant at Kalabagh, but even the completion of the study phase was not expected until early 1969. The $262 million Karachi plant, which would produce flat products and billets for sale to rerollers, was under study by International Construction Company of London; while the $292 million Kalabagh plant, slated to produce profiles, was to be studied by a Soviet Government group.

The economic viability of the recently opened (February 1967) Chittagong 150,000-ton-per-year steel plant was questioned in the Pakistani press during 1968. This facility, operating on imported pig iron and local as well as imported scrap, produced only 90,000 tons of ingot steel during its first year of operation. Difficulties cited included inadequate feedstock, staffing problems, and unfavorable price position relative to imports. Despite these problems, Pakistan's Commerce Minister indicated to the National Assembly that improvements were expected and that the mill would

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neither be shut down nor converted to a rerolling plant, as had been suggested in the press.

In November, it was reported that construction was underway on a 20,000-ton-per-year stainless and special steel plant at Karachi. This facility, which will include three 10-ton electric furnaces, rolling mills, and a continuous casting shop, is owned by the Pakistani Valika group, which was receiving financial and technical assistance from Ishikawajima-Karima Heavy Industries of Japan. Completion was scheduled for 1970.

NONMETALS

Barite.—Crown Mining Corporation, a barite mining firm operating for several years in the Lasbela area, completed a grinding plant in Karachi in September. Previously, the firm had sold its crude material to one of two other barite grinding companies in the country. Following completion of the crusher, Crown Mining reported that monthly mine output reached 1,000 tons, all trucked about 160 kilometers to the Karachi crusher. At yearend, the firm held an export license and had sold some barite in Near East oil countries. With a company-estimated potential annual market of 41,000 tons of barite (one-half domestic and one-half export), Crown Mining was seeking a joint venture arrangement with foreign interests to obtain capital for mill expansion.

Cement.—In West Pakistan, 9 plants produced 2,282,000 tons of cement, or 97 percent of national output; their combined annual capacity at yearend was 2,813,000 tons. A $21 million, 600,000-ton addition to the Zeal Pak Cement factory at Ganjo Takkar, the plant's fifth and sixth kilns, was completed in March. Output in West Pakistan was adequate to meet not only needs there, but also to provide for planned shipment of 400,000 tons to East Pakistan and 180,000 tons for export during the year beginning July 1, 1967.

The chromic cement shortage in East Pakistan continued through 1968. This area has but one cement plant, at Chittagong, which operated at 44 percent of its 150,000-ton annual capacity in 1968 (64 percent in 1967), apparently owing to difficulties in obtaining sufficient limestone. In addition to its own output, and receipts from West Pakistan, East Pakistan imported cement from other countries. Among the imports was a planned 150,000 tons from mainland China during the year beginning July 1, 1968, in a barter deal for cotton and jute.

To reduce cement import costs, the East Pakistan Industrial Development Corporation had contracted in 1966 with a French firm for erection of a $3 million, 366,000-ton-per-year clinker grinding plant at Chittagong to operate on imported clinker. Completion, scheduled for 1968, was unreported at this writing.

Fertilizer Materials.—With 6 existing plants and an aggregate annual national capacity of about 318,000 tons of urea, 86,000 tons of ammonium sulfate, 75,000 tons (estimated) of ammonium nitrate, and 18,000 tons of superphosphate, Pakistan had under construction or was planning for completion by 1970, a total of nine new plants and a number of additions to existing facilities. In West Pakistan, three new 340,000-ton-per-year each urea plants, one 150,000-ton triple superphosphate plant and one 600,000-ton ammonium sulfate and nitrate plant were programed; while for East Pakistan, two new 340,000-ton urea plants and two 120,000-ton triple superphosphate plants were scheduled. Scheduled additions to existing facilities would further increase national annual capacity by 60,000 tons of ammonium sulfate, 29,700 tons of ammonium sulfate, and 16,500 tons of urea.

Aside from these plant developments, it was reported that in the Dhariala area, about 200 kilometers south of Rawalpindi, the West Pakistan Industrial Development Corp. commenced deep exploratory drilling of potassium chloride-containing brine deposits. This effort was the first in Pakistan aimed at production of potash materials.

Gypsum.—Despite the sharp drop in output recorded in 1968, an immense potential market for gypsum may develop in West Pakistan's Indus River Basin as a result of experiments in soil improvement concluded late in 1967. In a test by the West Pakistan Department of Agriculture with cooperation from the U.S. Agency for International Development (AID), powdered gypsum was applied to soil that had lain barren for 25 years because of its high

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saline content, and a profitmaking rice crop was raised within 7 months, despite a gypsum price of $25 per ton and a requirement of 6 tons of gypsum per acre. The test indicated that the gypsum application need not be repeated so long as the ground water table is kept sufficiently low and the land is properly irrigated. Moreover, the gypsum supplier, the Ismail Industries, Ltd., indicated that the per-ton cost could be lowered to $8.40 per ton. Further experiments were scheduled, and programs were to be started to encourage farmers to apply gypsum under a plan whereby the cost of gypsum would be shared by the Pakistan Government, AID, and the farmers. Nearly 17 million acres of Indus Basin lands are contaminated, and a significant increase in gypsum production may occur if further testing proves that gypsum application is feasible for large areas. Gypsum reserves are regarded as more than adequate to supply such a demand level (over 100 million tons total for all saline land), and development of this technique comes at a time when national gypsum output has greatly decreased at least partly because of Pakistan's loss of its export market to India.

MINERAL FUELS

Pakistan's total energy consumption (excluding fuelwood and animal dung) was estimated at 11 million metric tons of standard coal equivalent (SCE) in 1968, compared with a reported 10,345,000 tons SCE in 1967. Of total 1967 energy consumption, coal provided 19 percent, oil 55 percent, gas 24 percent, and hydropower 2 percent. Of coal's share, somewhat less than one-half evidently was imported, while in the case of oil, imports accounted for 90 percent of the total; all gas and hydropower was of indigenous origin.

Coal.—Pakistan's coal industry, with a generally high-cost, low-quality product compared with competing imported coal, appeared unlikely to meet the 3-million-ton-per-year production goal for 1970 set in the nation's third 5-year plan. In West Pakistan, where the entirety of this target was to be met, improvements in the Makerwal-Gullakhel collieries of the West Pakistan Industrial Development Corporation (WPIDC) were reported proceeding satisfactorily at yearend, and Japanese-financed development at WPIDC's Degari coal mines were completed. Nevertheless, it appeared that immediate future expansion of production significantly beyond the 1967 level of 1.4 million tons is unlikely.

Reserves in West Pakistan, where all production through 1968 originated, reportedly total about 335 million tons, but much of this total is substandard in terms of energy yield, with a heating value ranging between 7,400 and 10,500 British Thermal Units (Btu) per pound.

In East Pakistan, efforts to develop reserves variously estimated at 500 million to 1,000 million tons in the deep-lying Gondwana coal seams of the Rajshahi area apparently continued. Plans called for sinking two 24-foot-diameter, 3,900-foot-deep shafts at Jamalganj, with production to begin sometime after 1970.

Natural Gas.—During 1968, three gasfields were added to Pakistan's roster of producers. The Sui field in West Pakistan, traditionally the nation's foremost producer and rated among the world's ten largest gasfields on the basis of reserves, remained the dominant source, as shown in the following tabulation:

Field	Output (million cubic feet)	
	1967	1968
East Pakistan:		
Chhatak	922	697
Habiganj	------	476
Sylhet	6,970	5,934
Titus	------	809
West Pakistan:		
Dhulian (oilfield)	5,748	5,736
Mari	------	1,324
Sui	69,658	76,549
Total	83,288	91,525

The Titus field began producing in April to supply Dacca and Narayanganj; the new Habiganj field's output was entirely destined for use in the 9-megawatt Shahjibazar gas-turbine power station, which is claimed to be the world's largest such installation. Output from the Mari field was used solely by the new Dahaki urea plant.

Despite the steady rise in production, development of Pakistan's natural gas remained far short of potential. Recoverable reserves have been conservatively estimated at 20 trillion cubic feet in 16 fields, including 6.3 trillion cubic feet in the Sui field and 4 trillion cubic feet in the Mari field.

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Among the fields not in production at yearend but slated for early development were the 20-billion-cubic-foot Sari field only 80 kilometers north of Karachi and the Jaldi field (reserves not yet established) 80 kilometers south of Chittagong.

At yearend, a pessimistic note was sounded regarding rapid increases in gas output.[4] Expansion reportedly was being retarded by restrictions on imports of meters, regulators, and other such materials and more significantly by the fact that existing transmission facilities were very near to ultimate capacity. Even if work was started immediately, additional facilities would not be available before mid-1971. Presumably such restrictions would not apply to addition of single industry consumers such as the Shahjibazar powerplant, but hoped-for expansion in home use and small industry use in Karachi would be appreciably influenced.

Petroleum.—Pakistan's entire 1968 crude oil production was derived from five fields in the Potwar plateau area of West Pakistan. Of the 3,832,000 barrels produced, the Dhulain field supplied 60 percent, the Balkassar field 29 percent, and the Khaur, Joya Mair, and Tut fields together provided 11 percent. Domestic output, small by world standards and far short of requirements, had to be supplemented by large imports. In the hope of reducing the sizable foreign exchange expenditure, the Government continued to give high priority to oil exploration efforts. For the fiscal year beginning July 1, 1968, investment equivalent to $17.4 million was authorized.

Under previously authorized exploration expenditures, the Tut field and the Kot Sarang field, both near Rawalpindi, were discovered in early 1968, and the former was in production at yearend, while the test well in the latter was being deepened in hope of finding a more substantial source.

Exploratory wells underway at yearend included Oil and Gas Development Corporation's third well at Kand, 80 kilometers from Karachi; the same organization's first wildcat in East Pakistan at Samutang in the Chittagong Hills; and Pakistan Petroleum's Pezu wildcat. The latter site is across the Indus River from the Meyal well of Pakistan oilfields in the Cambelldur district, which struck oil at 12,405 feet during 1968 and which was being deepened at yearend.

Offshore exploration in the Bay of Bengal continued in 1968 and spudding in of the first offshore well was expected early in 1969. Pakistan Shell Oil Co., in which the Government holds a 25-percent share, has an 8,000-square mile concession in this area.

Pakistan's oil refining capacity advanced sharply in May 1968, when the 30,000-barrel-per-day Eastern Refinery Ltd. Chittagong plant came on stream. This facility, in which 70 percent of the capital is from Pakistanis and 30 percent from the Burmah group of companies, was the first to be built in East Pakistan and raised national capacity by 40 percent to 105,000 barrels daily. Other refineries at yearend were the 53,000-barrel-per-day Karachi plant of Pakistan Refinery Ltd., the 12,000-barrel-per-day Karachi plant of National Refinery Ltd., and the 10,000-barrel-per-day plant of Attock Oil Co., Ltd., near Rawalpindi.

[4] Gas World. V. 169, No. 4404, Jan. 11, 1969, p. 90.

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The Mineral Industry of Peru

By Robert A. Whitman [1]

The value of Peru's mineral production increased by nearly 10 percent in 1968 to $473 million, returning to about the 1966 level. The increase was the result of increased output of most metallic minerals and of increased unit values for gold, silver, copper, lead, and iron ore. Zinc was the only metallic ore produced in quantity which declined in unit value.

It appeared that Peru would have a favorable trade balance for the year. Preliminary figures for 1968 indicated an increase of 14 percent in the value of exports and a decrease of 23 percent in the value of imports. The value of exported minerals accounted for about 52 percent of the total exports. Thus the mining industry continued to be an important revenue-producing segment of the economy. The austerity program initiated in June and July under the Belaunde Government which drastically curtailed imports and imposed new taxes began to slow the inflation. The fiscal reform was continued by the military junta which took over the Government on October 4. However, the flow of new investment, considered necessary to success of the reform, slowed significantly. The new military government expropriated the La Brea y Pariñas oilfield operated by the International Petroleum Co. (IPC). As of yearend 1968, there was no settlement of compensation agreeable to both parties to the action. This, combined with a reorganization of the Government, led to a virtual halt to the inflow of new capital investment. New ministries, apparently lacking guidelines, by yearend had not yet acted upon the investment plans presented by the mining companies. Indicators of the general economic progress of Peru are tabulated in the accompanying table as follows:

Some of the laws and decrees affecting the mining industry, which were passed during 1968, follow.

Law 16892, promulgated February 24, 1968, extensively revised Article 56 of the Mining Code and, through revisions in the tax structure and changes in the depletion allowance, made the investment climate much less favorable for foreign capital. Two sections, in particular, could be subject to ambiguous interpretation. The first section mentions various worker benefits to be decided by terms of the contract. The second refers to obligations of the mining company to establish refining and manufacturing entities.

Supreme Decree 074–68–HC, published

[1] Physical scientist, Division of International Activities.

	1966 [1]	1967 [1]	1968 [p] [2]
Gross national product (GNP) at current prices ---- millions	$5,091	$5,883	$6,001
Population ---- do	12.0	12.4	12.8
GNP per capita	$424	$474	$466
Cost of living index (1966 =100)	100	122.6	131
Commodity trade:			
Exports f.o.b ---- millions	$764	$757	$866
Imports c.i.f ---- do	$816	$819	$630
Trade balance ---- do	−$52	−$62	+$236
Total mineral production ---- do	$477	$431	$473
Mineral production as percentage of GNP	9.4	7.3	7.9

[p] Preliminary.
[1] U.S. Embassy, Lima, Peru. Semiannual Economic Trends Report (unclassified portion). State Department Airgram A–548, Mar. 24, 1968, 2 pp.
[2] U.S. Agency for International Development. Economic Data Book, Peru. Rev. No. 244, March 1969.

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March 28, deals with the exchange rate to be used for tax payments.

On June 11, 1968, The Southern Peru Copper Corp. (SPCC) agreed that it had recovered its original investment and would pay the regular income tax of 51.415 percent retroactive to January 1, 1968.

Supreme Decree 298–68–HC of August 14, 1968, rewrote the Organic Law of the Mining Bank. Essentially, the new law will give the Bank much more freedom and allow it to act more dynamically in fulfilling its objective of promoting the national mining industry. Some of the more important changes are—

1. The authorized capital of the Mining Bank (Banco Minero del Peru) has been increased from PS1,000 million to PS3,000 million (from approximately $250 million to $750 million).

2. Three new directors will be appointed, one each from the Ministry of Finance, Department of Mines, and the Engineering Association of Peru.

3. To assist small miners, the Mining Bank can either loan money at 5-percent interest annually for not longer than 5 years or participate in the project in return for rights in the mineral deposit concerned.

4. The Mining Bank can now participate alone or with other investors in exploration, exploitation, or mechanization of mines or other installations or infrastructural works. Previously the Mining Bank only operated concentration plants for small miners.

5. The Mining Bank is authorized to issue and sell bonds in Peruvian or foreign currency which will be exempt from income and other taxes.

Supreme Decree 340–68–HC required companies organized with foreign capital and which manufacture petrochemical, fertilizer, or chemical products to be established as Peruvian companies. They were obliged to offer at least 30 percent of their shares to Peruvians, and at least two-thirds of the membership of the board of directors were to be Peruvians residing within the country. The requirement of board membership was to be met within 60 days. The Peruvian Government could take up any stock not acquired by individual Peruvians.

Supreme Decree 347–68–HC declares the construction industry to be of preferential national interest. Article 11 states that projects to benefit large mining programs must be carried out by the companies' own personnel or by Peruvian construction companies. There may be some problems should future projects require technology or capital equipment and investment not readily available in Peru.

Supreme Decree 285–68–HC, August 9, 1968, exempts mining concessionaires whose production was valued at less than $5 million during 1967 from the payment of the 10 percent advance on the income tax.

The Mining Bank sold three of its five custom concentrating plants to neighboring mining companies in 1968—La Virreyna in the Castrovirreyna Zone, Sacracancha in the Yauli Zone, and Huarochiri in the Huarochiri Zone. Huachocolpa (in Huancavelica) and Dorado (in Hualgayoc) continue treating custom ores.

Some of the factors having a negative effect on new mining investment are —

1. Peru's new foreign exchange controls which require all earnings from foreign sales to be returned to Peru and to be exchanged for dollar certificates at soles 38.70 to the dollar. The controls appeared to contradict those provisions of Article 56 of the Mining Code which gave control of their foreign exchange to the mining companies.

2. Equipment purchased outside Peru is subject to a 10-percent tax on the c.i.f. value of the merchandise.

3. The difficulty in getting foreign exchange to remit earnings and depreciation as these funds become disposable.

4. A sharp tax increase from 47.8 percent to 54 percent.

5. Depreciation must be taken in soles at the exchange rate prevailing at the time of the purchase of the equipment.

PRODUCTION

Preliminary production figures indicate that value of minerals produced in 1968 rose by 9.7 percent over that for 1967. Principal gains in value occurred in gold, silver, copper, molybdenum, tungsten, and iron. There was an increase in the output of all metals and metallic minerals except gold, bismuth, cadmium, and iron. This

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is based on preliminary information obtained from the Ministry of Energy and Mines. There were no figures available for nonmetallic mineral production.

Production figures for metals in Peru essentially represent a calculated recoverable content. In calculating recoverable metals, the Peruvian Department of Mines reportedly has deducted from the assayed metal content of the ores and concentrates 5 percent for copper and lead, 10 percent for zinc, iron, manganese, molybdenum, and tungsten, and 35 percent for arsenic, bismuth, cadmium, and tin. These deductions were based on average recoverability experience.

Table 1.—Peru: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Antimony:					
Mine output, metal content	682	647	672	742	816
Metal	384	297	372	325	352
Arsenic, white	621	500	365	270	1,227
Bismuth:					
Mine output, metal content	739	808	759	810	797
Metal	721	745	747	774	797
Cadmium:					
Mine output, metal content	227	327	302	444	271
Metal	197	215	200	151	172
Copper:					
Mine output, metal content	176,445	180,336	176,894	190,511	218,481
Cement	885	510	---	NA	---
Copper sulfate	668	533	653	660	728
Metal:					
Blister, including secondary	114,246	118,161	113,102	121,701	147,624
Refined, including secondary	37,821	40,461	37,974	35,010	38,500
Gold:					
Mine output, metal content e troy ounces	92,503	105,183	94,978	84,636	82,512
Metal e do	48,447	45,671	40,285	43,119	40,574
Indium metal kilograms	---	---	541	160	312
Iron and steel:					
Iron ore and concentrate thousand tons	6,528	7,104	7,787	8,586	8,544
Pig iron (excluding blast furnace ferroalloys) thousand tons	27	20	r 12	31	NA
Steel, ingot and casting do	82	94	80	80	105
Lead:					
Mine output, metal content	150,674	154,344	144,760	159,621	167,798
Metal, including secondary	89,724	86,807	88,762	81,815	88,371
Manganese:					
Ore and concentrate, gross weight	372	990	798	1,073	7,153
Metal	167	446	357	483	2,482
Mercury, mine output, metal content 76-pound flasks	3,275	3,117	3,166	3,128	3,119
Molybdenum, mine output, metal content	395	680	672	598	809
Selenium, elemental kilograms	7,619	8,602	5,956	4,810	5,766
Silver:					
Mine output, metal content thousand troy ounces	34,419	36,470	32,841	32,107	36,020
Metal, including secondary do	22,350	21,071	19,930	19,826	20,685
Tellurium, elemental kilograms	21,209	16,350	17,987	14,828	16,017
Thallium, metal do	---	100	50	50	---
Tin:					
Mine output, metal content long tons	36	49	37	65	99
Metal, including secondary do	---	---	---	---	5
Tungsten, mine output, metal content	307	379	346	332	509
Zinc:					
Mine output, metal content	236,660	254,496	257,819	304,799	309,099
Metal, including secondary	61,920	62,932	63,450	63,352	68,032
NONMETALS					
Barite	125,420	110,771	116,645	110,000	66,642
Cement, hydraulic thousand tons	813	1,017	r 1,069	1,042	1,098
Clays:					
Bentonite	603	5,020	1,668	17,000	NA
Fire clay	10,006	9,493	8,500	5,233	4,020
Kaolin	330	390	417	---	1,024
Common	260,567	290,520	290,000	320,000	47,914
Diatomite	2,593	2,471	1,580	3,736	3,398
Feldspar	850	941	478	2,500	1,889

See footnotes at end of table.

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Table 1.—Peru: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS—Continued					
Gypsum:					
Crude	50,036	76,330	63,840	65,000	NA
Calcined	32,869	39,929	NA	NA	NA
Lime	92,488	NA	NA	NA	7,659
Phosphate, guano	205,099	169,897	55,505	64,891	32,947
Salt, all types	132,887	137,531	172,997	140,660	132,161
Stone:					
Dimension, marble	1,133	1,549	1,000	NA	1,058
Crushed and broken:					
Dolomite	1,500	2,204	2,942	4,800	5,999
Gravel and sand—thousand tons	1,482	1,732	2,477	2,010	2,219
Limestone—do	1,438	1,960	1,685	1,900	NA
Quartz and marble	300	500	---	NA	NA
Silica	69,757	69,383	60,000	55,000	61,310
Talc and related materials:					
Pyrophyllite	3,592	4,192	3,835	4,469	NA
Talc	170	285	---	NA	306
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite	31,737	7,730	13,684	5,000	NA
Bituminous	115,347	121,200	140,988	170,048	290,980
Coke, all types	25,568	27,402	34,927	41,202	41,727
Gas, natural—million cubic feet	58,681	63,652	58,720	56,904	75,792
Natural gas liquids—thousand 42-gallon barrels	1,082	1,156	1,092	1,095	627
Petroleum:					
Crude oil—do	23,119	23,068	23,027	25,857	27,056
Refinery products:					
Aviation gasoline—do	46	54	34	34	27
Motor gasoline—do	6,089	5,980	6,893	7,294	9,613
Jet fuel—do	725	789	1,025	1,175	1,322
Kerosine—do	3,139	3,270	3,438	3,620	3,886
Distillate fuel oil—do	5,958	6,254	6,037	5,638	6,695
Residual fuel oil—do	5,042	5,431	5,773	6,154	8,162
Lubricants—do	e	84	81	76	64
Asphalt—do	12	198	234	192	161
Other—do	8	182	94	295	779

e Estimate. p Preliminary. r Revised. NA Not available.
1 Sales.

TRADE

Copper contributed over half of the total mineral export value for Peru in 1967 and 1968. Five minerals listed in the table of selected mineral exports constituted about 96 percent of the value of minerals exported. As in 1967, there was a definite increase in value per unit for copper and silver, nullifying the decreases in unit values for lead and zinc.

Table 2.—Peru: Selected mineral products, exported (f.o.b.)

Mineral product (fine content)	1966 [1]		1967 [2]		1968 p [2]	
	Metric tons	Value (millions)	Metric tons	Value (millions)	Metric tons	Value (millions)
Copper	176,138	$186	191,096	$194	199,838	$238
Silver	1,100	41	984	44	1,040	69
Iron	4,858,679	53	5,314,415	68	5,421,676	65
Lead	150,901	35	146,079	30	155,480	31
Zinc	282,153	34	285,907	37	323,786	38

p Preliminary.
1 Estadística del Comercio Exterior, 1966, Ministerio de Hacienda y Comercio, Superintendencia Nacional de Aduanas, Lima, Peru. Exchange rate, 26.82 soles per dollar.
2 U.S. Embassy, Lima, Peru. State Dept. Airgram A-250, June 25, 1969, 12 pp., 3 encl., 7 pp.

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Mineral commodities continued to represent slightly over 50 percent of the value of all Peruvian exports. The United States, Japan, Belgium, and West Germany represented the major mineral markets for Peru and received 90 percent of the minerals exported in 1968. The share taken by the United States, 43.9 percent, was about 3.5 percent less than in 1967.

During 1967, the last year for which official import figures are available, the value of imports from the United States fell from 39 percent of the $816 million total in 1966 to about 37 percent of the $819 worth of imports for the whole economy.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	377	764
1967	385	757
1968 p	452	866
Imports:		
1966	74	816
1967	96	819
1968 p	75	680
Trade balance:		
1966	+303	−52
1967	+289	−62
1968 p	+377	+286

p Preliminary.

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Table 3.—Peru: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Antimony:			
Ore and concentrate	1,044	704	Belgium-Luxembourg 239; Argentina 191; Japan 91.
Metal, including alloys, all forms	300	196	Mainly to United States.
Bismuth, metal, including alloys, all forms	781	835	United States 519; France 82.
Cadmium:			
Intermediate metallurgical products	39	90	(1).
Metal, including alloys, all forms	212	155	United States 97; Belgium 22; Netherlands 20.
Copper:			
Ore and concentrate	90,167	123,563	Japan 80,953; United States 20,609; Sweden 14,048.
Matte and cement	858	765	Mainly to United States.
Metal, including alloys:			
Blister	121,724	130,875	United States 80,512; West Germany 22,752; Belgium-Luxembourg 22,367.
Refined	32,020	36,003	United States 29,416; Netherlands 5,582.
Gold:			
Ore and concentrate [2]—troy ounces	43,595	24,692	(1).
Metal [2]—do	10,044	1,540	(1).
Iron and steel:			
Ore and concentrate	7,679,853	8,497,147	Japan 6,816,556; United States 944,619.
Scrap	10	35	Netherlands 10; Bolivia 8.
Lead:			
Ore and concentrate	125,852	140,700	United States 71,869; Belgium-Luxembourg 25,004; Japan 19,937.
Metal, including alloys, all forms	86,831	79,762	Mainly to United States.
Manganese, ore and concentrate	--------	192	All to Spain.
Mercury, ore and concentrate [3] 76-pound flasks	2,768	3,255	United States 1,301; Netherlands 1,270.
Molybdenum, ore and concentrate	1,609	1,948	West Germany 1,034; France 719.
Selenium, elemental—kilograms	6,739	4,872	Mainly to United States.
Silver:			
Ore and concentrate [2] thousand troy ounces	14,794	11,756	(1).
Metal, including alloys [2]—do	20,576	33,945	(1).
Tellurium, elemental—kilograms	51,447	14,929	United States 7,730; Norway 3,200.
Tin, ore and concentrate—long tons	53	146	Netherlands 113; United Kingdom 33.
Tungsten, ore and concentrate	672	741	Japan 485; United States 243.
Zinc:			
Ore and concentrate	429,810	450,491	Japan 290,554; United States 112,524; France 28,550.
Metal, including alloys, all forms	56,377	65,507	United States 33,677; Brazil 13,760.
Other:			
Ash and residue containing nonferrous metals	4	18	All to Belgium-Luxembourg.
Base metals, including alloys, all forms, n.e.s	408	341	Mainly to United States.
NONMETALS			
Barite, crude	91,680	67,439	Do.
Cement	5,320	15,860	Mainly to Bolivia.
Chalk	15	20	All to Ecuador.
Clays:			
Bentonite	46	50	Do.
Other	--------	7	Ecuador 5; Bolivia, 2.
Guano	2,100	21	All to United States.
Gypsum	--------	1	All to Ecuador.
Salt	182	240	Mainly to Ecuador.
Stone	--------	101	Italy 53; Japan 48.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets	50	--------	
Petroleum:			
Crude—thousand tons	278,900	338,984	United Kingdom 165,349; Brazil 46,441; West Germany 46,300.
Refinery products:			
Gasoline, aviation	--------	7	All to France.
Gasoline, motor	368	384	Chile 302; Colombia 71.
Kerosine	37	90	All to Chile.
Distillate fuel oil thousand tons	r 42,249	67,420	West Germany 18,565; Japan 17,346; Chile 13,220.
Residual fuel oil	39,392	32,155	Mainly to bunkers.
Lubricants	2,019	760	Mainly to Chile.
Other	380	--------	

r Revised.
1 Country distribution not separately reported.
2 Content in ores, concentrates, and refinery products of base metals included.
3 Metal content of ores and concentrates.

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Table 4.—Peru: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Unwrought	2,429	3,062
Semimanufactures	r 1,580	1,723
Cadmium metal, including alloys, all forms--kilograms	48	366
Chromium:		
Oxides-----do	24,152	24,1.3
Metal, including alloys, all forms---kilograms	396	433
Copper, metal, including alloys, all forms:		
Unwrought---kilograms	12,001	2,818
Semimanufactures	901	795
Gold:		
Ore and concentrate troy ounces	-------	3,729
Metal, unworked or partly worked---troy ounces	373	207
Iron and steel:		
Ore and concentrate	-------	36
Metal:		
Scrap	1,747	16,334
Powder, shot, and sponge	224	218
Ferroalloys	1,477	1,238
Semimanufactures:		
Bars, rods, angles, shapes, sections	34,464	62,699
Universals, plates, and sheets:		
Uncoated	65,873	95,452
Tinned	24,495	23,357
Other coated	8,927	12,244
Rails and accessories	9,921	10,744
Wire	6,814	4,283
Tubes, pipes, and fittings	25,323	31,594
Lead metal, including alloys, all forms	64	57
Magnesium metal, including alloys, all forms--kilograms	2,461	4,805
Mercury-----76-pound flasks	16	36
Nickel metal, including alloys, all forms	70	66
Platinum-group metals, including alloys, all forms troy ounces	567	748
Silver metal, including alloys troy ounces	9,099	9,645
Tin metal, including alloys, all forms----------long tons	201	203
Zinc:		
Oxide	26	25
Metal, including alloys:		
Unwrought	59	11
Semimanufactures	228	147
METALS—Continued		
Other:		
Ore and concentrate	1,669	3,080
Metals, including alloys, all forms	5	3
NONMETALS		
Abrasives, natural, n.e.s	3,695	3,722
Asbestos	3,533	4,240
Barite and witherite	98	308
Cement	157,297	99,877
Chalk	2,071	2,090
Clays:		
Bentonite	805	2,307
Kaolin	1,628	3,543
Other	680	3,009
Feldspar and fluorspar	635	805
Fertilizer materials:		
Crude:		
Nitrogenous	2,455	1,331
Phosphatic	1	50
Potassic	2,069	2,649
Manufactured:		
Nitrogenous	64,404	93,547
Phosphatic	223	1,085
Potassic	2,012	3,762
Other	6,252	5,665
Ammonia	35	32
Graphite	78	68
Gypsum	209	432
Magnesite	1,273	3,284
Mica, all forms	140	166
Salt, all forms	2,687	2,714
Stone, sand, and gravel:		
Dimension stone	803	726
Dolomite	-------	440
Gravel and crushed rock	41	91
Sand, excluding metal bearing	2,450	1,883
Sulfur, elemental, all forms	r 13,253	14,165
Talc	807	932
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	981	401
Carbon black and gas carbon	3,179	3,182
Coal, all grades, including briquets	10	763
Coke and semicoke	4,511	11,682
Petroleum:		
Crude and partly refined	r 125,472	167,872
Refinery products:		
Gasoline, aviation	41,181	113,771
Gasoline, motor	r 243,355	57,559
Kerosine and jet fuel	-------	46,986
Diesel oil	635,957	341,905
Lubricants	r 147,684	170,911
Mineral jelly and wax	11,919	14,000
Other	r 1,347	1,750

r Revised.

Source: Estadística del Comercio Exterior, 1966 and 1967, Ministerio de Hacienda y Comercio, Superintendencia Nacional de Aduanas, Lima, Peru.

COMMODITY REVIEW

METALS

Copper.—The SPCC submitted a proposal in November for a $335 million investment to develop the Cuajone porphyry copper deposit, about 26 kilometers northwest of Toquepala. About 5 years will be required to build a town, a 30,000-ton-per-day flotation mill, a railroad spur, and to strip about 160 million tons of waste from above the 530 million tons of 1 percent copper ore delineated by an extensive diamond drilling program. Successful com-

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pletion of this development would nearly double the company's 1968 output of 134,000 tons of blister copper. The increases in 1968 for Toquepala in ore and waste mined, ore processed, and blister copper produced, over the quantities for 1967, all were about 6 percent. Salient statistics for SPCC operations for the years 1966–68 follow:

	1966	1967	1968
Ore and waste mined thousand metric tons	51,687	58,940	62,48
Ore treated do	11,503	12,297	13,056
Ore-to-waste ratio	1:3.5	1:3.8	1:3.8
Copper content of—			
Ore treated percent	1.22	1.18	1.21
Blister copper produced metric tons	118,980	126,507	134,010

During 1968, SPCC paid the full prevailing tax rate in Peru of 54.5 percent of taxable income.

Cerro de Pasco Corp. maintained its position as the second largest copper producer, and No. 2 taxpayer, in Peru during 1968. It increased production of copper by over 42 percent to above 53,000 tons. Most of the increase was attributed to the production from the Cobriza underground mine. The mine, said to be the most highly mechanized underground mine in Peru, represents an investment of $18 million. Although started in December 1967, it was officially inaugurated by the President of Peru in July 1968. The company plans to increase capacity of the concentrator from 1,000 to 4,000 tons per day.

A tabulation of the principal metal and mineral production of all the Cerro de Pasco operations follows:

	1966	1967	1968
Copper metric tons	89,710	37,387	53,210
Lead do	88,531	81,651	86,346
Zinc:			
Refined do	61,387	61,715	65,873
In concentrates metric tons	76,450	84,918	80,680
Bismuth do	747	775	792
Gold troy ounces	35,621	37,178	43,160
Silver thousand troy ounces	19,868	19,507	20,371

In spite of the increase in production from all mines, Cerro de Pasco's reserves continued to increase as a result of development work on its properties.

Work continued on the expansion of the electrolytic copper refinery at La Oroya, and facilities for a 100-million-pound copper wire bar rolling mill and 200-ton-per-day sulfuric acid plant were completed by yearend.

The first of several shipments of copper concentrate said to total over 25,000 tons was loaded by Lepanto Consolidated Mining Co. at San Fernando, Philippine Islands, to go to Callao, Peru, for smelting at La Oroya.

The amount of disseminated copper as a proven reserve at Morococha has been increased to 360 million tons, over twice the tonnage reported in December 1967. It has an average assay of around 0.76 percent. Fortunately, the mineralized zone is in near-surface limestone for high-tonnage open-pit mining.

Over 90 percent of the twin Graton drainage tunnels, which will drain the lower workings of the Casapalca mine, have been completed. Water inflows as high as 134,000 gallons per minute, temperatures as high at 154° F, hot rock, and heavy ground have been encountered and overcome in drilling the two tunnels which were started in 1961.

Northern Peru Mining Co. produced 19,840 tons of copper concentrates averaging 31.7 percent copper from the Quiruvilca mine. In addition, the mine produced about 676 tons of cement copper, 4,745 tons of zinc concentrates (53.6 percent zinc), and 1,710 tons of lead (54.7 percent lead).

Minas de Chapi de Peru, S.A., was scheduled to increase production of ore averaging 2.4 percent copper to 20,000 tons per month in early March. The mill was expected to produce about 2,000 tons of copper concentrate per month for shipment to Japan. The Chapi mines, owned by Japanese interests, are about 80 kilometers from Arequipa.

The Katanga copper-gold mine was sold to Japanese interests. Located in the Province of Chumbivilcas, Department of Cuzco, the mine has almost 1 million tons of proven ore averaging 3.5 percent copper. About one-fourth of the deposit is high-grade ore, averaging 8.1 percent copper, 0.2 ounce of gold, and 2.4 ounces of silver per ton.

The Berenguela mine, near the town of Santa Lucia in southern Peru, reportedly was optioned by Charter Consolidated, an Anglo-American company. Interest in this copper-silver property has been renewed because of the availability of the TORCO (Treatment of Refractory Copper) process

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from Anglo-American which may make profitable recovery of the copper possible.

Iron Ore.—Peruvian iron ore may be shipped overseas in the form of slurry. In August, the second 3,500-ton trial cargo of iron ore slurry was discharged at the Chiba plant of the Kawasaki Steel Co. in Japan. Modifications of techniques used in handling the trial cargo resulted in an increased percentage of solids in the slurry and a substantially higher discharge rate. It was planned to ship superconcentrate (about 69 percent iron) in slurry form in a specially designed ore carrier from the Marcona mine in Peru to a new steel plant at Portland, Oreg. The ore is transported to the port at San Nicolas from the mine via a steel-cord belt conveyor system 20 kilometers in overall length. The belt conveyor system can transport 2,000 tons per hour or over 12 million tons of iron ore annually.

In August, The Pan American Commodities, S.A., suspended operations at the Acarí iron mine, some 500 kilometers south of Lima in northern Arequipa Department. The production of iron ore had diminished from over 1.2 million tons annually in 1960 and 1961 to about 0.5 million tons in 1967.

Lead and Zinc.—In June 1968, the President of Peru formally inaugurated the Huanzala lead-zinc mine in the Province of Dos de Mayo, Huanuco Department. The mine, operated by the Japanese owned Cía. Minera Santa Luisa, reportedly was producing 500 tons of ore daily and 5,000 tons of concentrate per month. Reserves were estimated at 2,200,000 tons containing 13 percent zinc, 7 percent lead, and 1 percent copper.

A shift from open pit to underground mining was effected by Cía. Minerales Santander, Inc., during 1968. A 700-foot shaft and related facilities were completed during the year. The company, a wholly owned subsidiary of St. Joseph Lead Co., produced 69,199 tons of zinc concentrate averaging 49.88 percent zinc, and 8,514 tons of lead concentrate averaging 39.62 percent lead. Millheads at the concentrator averaged 13.12 percent zinc, 0.38 percent lead, 0.39 percent copper, and 2.67 ounces of silver per ton. There was a total of 1,404 meters of development drilling during 1968.

The Chilete lead-zinc mine of Northern Peru Mining Co. was closed down in April.

NONMETALS

Phosphates.—The Sechura phosphate deposits may not soon be developed because of changes in the world supply. The recent discovery of high-grade deposits in the French Sahara and the need for a complete infrastructure to be built on the Sechura Desert by the Peruvian Government at a cost estimated at $50 million makes any major mining investment there appear unlikely at present.

MINERAL FUELS

The two most important events occurring in the petroleum industry in Peru in 1968 were the Act of Talara in August which was intended to resolve the problem of the La Brea y Pariñas holdings of the International Petroleum Co. (IPC) and the Act of Expropriation in October, resulting in tensions which were not yet resolved at yearend. The Act of Talara, signed August 13, provided that IPC would give the Government of Peru a quit-claim deed to the La Brea y Pariñas oilfield and installations and in return receive rights for modernization of the refinery at Talara and for exploration concessions in the Oriente Eastern Zone. However, before the Act was implemented, the Armed Forces overthrew the administration of President Belaunde Terry on October 3, declared the Act of Talara null and void on October 4, and expropriated both the La Brea y Pariñas oilfield and the Talara refinery complex on October 9. At yearend, there were no arrangements for compensation.

Although the Government of Peru realizes that exploration for oil is expensive and risky, they have abandoned the concept of direct concessions, except for those already in effect, and have authorized Empresa Petrolera Fiscal (EPF) to enter into operating contracts with private companies.

EPF controlled 93 percent of the 41 million hectares under concession and the remaining 7 percent was held by 15 private companies. These latter companies held about 35 percent of the hectares under exploration concession with about 73 percent of this amount being on the Continental Shelf. Private companies held about 4.6 percent of exploitation concessions with around 95 percent of this in the Eastern Zone of high risk and high cost.

There were 41 exploration wells drilled in 1968, of which 26 were offshore and 12

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in the Eastern Zone. Of the offshore group, four were producing, 18 were abandoned, and four were still drilling at yearend. In the Eastern Zone, three were producing, six were abandoned, and one was still being drilled at yearend.

There were 128 development wells drilled in 1968, and all but five were producers. Of the producing wells, 108 were located in the Continental Shelf or Coastal Zone. There were 11 drilling rigs actively drilling or testing development wells, and there were 256,994 feet of well drilled.

Geological and geophysical exploration activities decreased from 73.5 party months in 1967 to 58.25 party months in 1968. EPF logged 10 party months on surface geology and two on gravimetry. Eight private companies also were engaged in this work, and they logged 17.5 party months on surface geology, 13.25 with the seismograph, three with the gravimeter, 2.5 on sparker tests, and 10 divided among side-scan sonar, engineering, and aeromagnetic tests. Peruvian Gulf, Belco Petroleum and Mobil Oil were the most active in this work.

The Mobil-Union group drilled two dry wells in the Rio Santiago jungle area and decided to suspend exploration activities there for the present.

Production of crude petroleum increased only 4.6 percent over the 1967 quantity. The increase occurred in offshore production by the Belco Petroleum Co. which more than offset decreases in production in the Coastal Zone (La Brea y Pariñas) and the Eastern Zone (El Oriente at Maquia). The Eastern Zone contributed only about 4 percent of total production, but the Coastal Zone, from which production is expected to decline further, furnished two-thirds of Peru's crude oil. Unless further development produces new supplies, the country will be faced with greater imports which in turn depletes foreign exchange.

The La Brea y Pariñas field produced over 40 percent of all the natural gas in Peru with a utilization rate of nearly 82 percent. This high rate brought the overall rate for the country up to about 54 percent, as many fields had low utilization rates and flared over 90 percent of their production. La Brea y Pariñas together with the Lima concessions produced over 76 percent of Peru's gas. A tabulation of 1968 production and use of natural gas follows:

	(Million cubic feet)
Production of natural gas	75,792
Liquefied gas	3,555
Used as fuel	13,248
Returned to the oilfield	14,594
Used as gas-lift	9,806
Released to atmosphere	34,589
Utilization—percent	54.36
Released—do	45.64

Although Peru has about 2.5 trillion cubic feet of natural gas reserves, the greater part lies on the eastern slope of the Andes Mountains or in the Amazon Basin and therefore far from the largest potential market. Most of the production came from the fields in the far northwest part of the country.

La Pampilla refinery of EPF produced 5.7 million barrels of refined petroleum products during its first full year of opera-

Table 5.—Peru: Distribution of crude petroleum production by zone and company

(Thousand 42-gallon barrels)

Zone and company	Production 1967	Production 1968 p
CONTINENTAL SHELF		
Belco Petroleum Corp. of Peru	3,517	7,492
Cabeen Exploration Co	957	(1)
Empresa Petrolera Fiscal	358	281
Total	4,832	7,773
COASTAL		
Belco Petroleum Corp. of Peru	81	66
Empresa Petrolera Fiscal	1,984	1,553
International Petroleum Co., Ltd., Lobitos	10,798	[2] 10,974
International Petroleum Co., Ltd., La Brea y Pariñas	6,974	[3] 5,564
Petrolera Amotape, S.A	10	14
Total	19,847	18,171
EASTERN		
Compañía Peruana de Petróles "El Oriente," S.A	591	500
Compañía de Petróleo "Ganso Azul," Ltda	587	612
Total	1,178	1,112
Grand total	25,857	27,056

p Preliminary.
[1] By yearend 1967, Belco Petroleum Corp. of Peru had purchased control of Cabeen Exploration Co., and associates. Their production is included with Belco.
[2] Concessions held jointly by IPC and Cía. Petrolera Lobitos. Operated by IPC.
[3] IPC from January 1 to October 9, 1968; EPF from October 10 to December 31, 1968.

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tion in 1968 and thus accounted for a nearly 25-percent gain for the refining industry in Peru. The following tabulation of refinery runs shows production for 1967 and 1968:

(Thousand 42-gallon barrels)

	Motor gasoline		Kerosine		Diesel		Residual fuel		Other	
	1967	1968	1967	1968	1967	1968	1967	1968	1967	1968
International Petroleum Company (Talara) [1 2]	3,913	6,384	2,575	3,076	4,307	5,880	3,679	4,640	[3] 6,010	1,859
Refinería Conchan-Chevron, S.A.	1,270	1,068	166	65	442	378	1,333	1,147	85	41
Cía. de Petróleo Ganso Azul, Ltda.	94	137	105	76	121	145	96	112	NA	4
Empresa Petrolera Fiscal:										
La Pampilla	NA	1,939	NA	611	NA	559	NA	2,164	NA	430
Iquitos	80	85	56	58	115	129	91	98	1	1

NA Not available.
[1] International Petroleum Co. operated the Talara refinery until October 9, 1968, after which the refinery was operated by EPF. Data are for the entire calendar year for Talara.
[2] Figures for 1968 include products produced at Talara for Cía. Pet. Lobitos, which did not report separately for 1968.
[3] Includes 4,305,818 barrels refined by IPC for Lobitos.

The four refinery products which accounted for 93 percent of the output were, in million barrels, motor gasoline 9.6, residual fuel oil 8.2, diesel oil 6.5, and kerosine 3.9.

Complete data on consumption were not available, but preliminary figures which did not include the eastern area show 9.5 million barrels of gasoline, 8 million barrels of fuel oil, 6 million barrels of diesel, and 3.7 million barrels of kerosine consumed in Peru in 1968. The Lima-Callao area accounts for about 50 percent of the total mineral fuel products consumption.

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The Mineral Industry of the Philippines

By Arnold M. Lansche [1], R. A. Pense [2], and K. P. Wang [3]

The gross national product (GNP) of the Philippines, at current prices, increased about 11 percent in 1968 to approximately $7.2 billion. Mining output, as compared with 1967, was up almost 12 percent to $236 million, equivalent to nearly 3.3 percent of GNP. Although copper was the primary mineral produced, gold, chromite, iron ore, and cement were also important, along with refined products derived from imported crude oil. Exports of base metal ores and concentrates, principally to Japan, constituted one of the largest sources of foreign exchange. Cement, iron and steel manufactures, fertilizers, and petroleum products were primarily produced for the domestic markets.

Substantial mineral development took place, particularly in copper, nickel, and sulfur. Marcopper Mining Corp. made rapid progress in developing its large copper deposit on Marinduque. Initial preparations were made to exploit nickel deposits on Nonoc and Palawan. Benguet Consolidated Inc. was moving ahead with work at its important sulfur deposit on Negros. The first new producing unit began operation at the integrated iron and steel plant being built at Iligan on Mindanao. Three new cement plants were put on stream and two others placed under construction.

The pending termination in 1974 of the Laurel-Langley agreement, which assures U.S. nationals of equal treatment with Philippine citizens in commercial operations, made itself felt more heavily in the mining industry in 1968. Atlas Consolidated Mining & Development Corporation, leading producer of copper in the Philippines, was notified that its leases would not be extended beyond 1974 unless its ownership were changed from predominantly U.S. to Philippine. Uncertainty concerning post-1974 business conditions allegedly was also a significant factor in bringing petroleum exploration activity to a year-end standstill.

The Philippine Bureau of Mines continued work on the preparation of new legislation to replace the country's basic mining code embodied in the Mining Act of 1936. The principal changes in the preliminary draft, which reportedly followed closely the Petroleum Act of 1949, were concerned with increasing the scale of individual mining operations and extending more clearly national jurisdiction over exploration and mining in territorial waters and on the continental shelf. At yearend, the new legislation had not yet been placed before the Philippine Congress.

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PRODUCTION

The approximate 24-percent increase in 1968 in copper output was principally owing to existing facility expansion at well-established mines and the development of additional pits. Mercury production benefited from a new kiln added in 1967. The small amounts of lead and zinc produced were principally as byproducts of copper and gold mining; the zinc was from gold-zinc ores mined at Tuba on Luzon and copper-zinc ores extracted at Bagacay on Samar. Byproduct cadmium was derived from the zinc and byproduct molybdenite mainly from copper ores of Sipalay mine on Negros. New cement manufacturers contributed significantly to the 21-percent increase in national output of this most important nonmetallic. An estimated 25-percent increase in petroleum consumption raised refinery production to new heights.

Breakdown of mineral output value (defined here as excluding value added) showed copper-in-concentrates, valued at $120 million in current prices, was the most important item in 1968. Cement was second with $56 million, followed by gold ($27.4 million), iron ore and concentrate ($12.1 million), chromite ($8.2 million), salt ($4.4 million), stone, sand and gravel, excluding silica sand ($4.3 million), and silver ($3.4 million). Not included in these data were iron and steel products, which were of some significance, and petroleum refinery products, which were of considerable importance.

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Table 1.—Philippines: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 •
METALS					
Cadmium, mine output, metal content	11	10	5	3	2
Chromite, gross weight—thousand tons	505	554	560	420	439
Copper, mine output, metal content—do	60	68	74	r 92	114
Gold—troy ounces	425,770	435,545	453,546	r 490,557	527,355
Iron and steel:					
Iron ore and concentrate—thousand tons	1,367	1,438	1,475	1,506	1,353
Ferroalloys	1,532	1,744	1,795	718	NA
Steel ingots and castings [1]—thousand tons	NA	114	148	r 187	210
Lead, mine output, metal content	108	105	92	95	84
Manganese ore and concentrate, gross weight thousand tons	8	52	56	86	66
Mercury, mine output, metal content 76-pound flasks	2,496	2,384	2,443	r 2,611	3,544
Molybdenum, mine output, metal content	105	77	49	r 25	43
Silver, mine output, metal content thousand troy ounces	908	933	1,163	1,396	1,575
Zinc, mine output, metal content	2,136	2,059	1,648	1,548	2,243
NONMETALS					
Asbestos	532	---	500	58	NA
Barite	1,476	---	2	NA	NA
Cement, hydraulic—thousand tons	1,201	1,529	1,613	2,112	2,566
Clays, white	6,967	• 7,000	• 6,000	• 6,000	6,000
Feldspar	8,051	12,289	8,615	NA	42,324
Fertilizer materials: Crude (natural):					
Nitrates	1,191	4,172	534	1,316	656
Phosphate rock	2,857	10	100	1	521
Gypsum and anhydrite, crude—thousand tons	41	27	15	15	8
Lime—do	29	24	24	84	105
Pyrite and pyrrhotite (including cupreous):					
Gross weight—thousand tons	44	105	114	146	182
Sulfur content—do	21	47	52	68	85
Quartz, glass sand—do	197	280	234	311	429
Salt, marine—do	47	255	188	116	187
Stone, sand and gravel, not elsewhere specified:					
Crushed and broken:					
Dolomite	5,220	5,149	4,135	6,794	6,198
Limestone—thousand tons	1,799	2,300	2,400	3,000	NA
Sulfur, elemental, from ore	69	48	14	24	42
Talc	98	593	637	444	506
MINERAL FUELS					
Coal, all grades—thousand tons	115	95	75	65	82
Petroleum: Refinery products:					
Gasoline, aviation and motor thousand 42-gallon barrels	9,189	9,474	11,218	r 12,792	13,720
Kerosine and jet fuel—do	2,544	3,238	3,803	r 3,775	5,807
Distillate fuel oil—do	6,881	7,139	8,450	r 9,533	11,261
Residual fuel oil—do	9,757	11,098	13,133	r 16,500	20,586
Refinery fuel and losses—do	1,500	1,700	2,338	r 2,913	3,721
Other, including unspecified—do	954	1,442	1,801	r 1,347	1,261
Total—do	30,285	34,086	40,733	r 46,860	• 56,356

• Estimate. r Revised. NA Not available.
[1] Rolled steel.

TRADE

Total commodity imports in 1967 were $1,172 million, up approximately 22 percent from the $957 million of 1966. Overall exports, however, declined about 5 percent to $812 million from $857 million in 1966.

The most important mineral exports were metalliferous ores and concentrates ($106 million in 1967 compared with $104 million in 1966); copper ores and concentrates alone reached $75 million in both 1966 and 1967. This category comprised about 12 percent of total commodity exports in 1966 and 13 percent in 1967.

Prominent among imports were crude oil and petroleum products (an estimated $94 million in 1967 compared with an estimated $84 million in 1966), base metals, including iron and steel products ($106 million in 1967 compared with $84 million in 1966), and manufactured fertilizers ($10.5 million in 1967 compared with $4.9 million in 1966). Together, these

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three components constituted about 18 percent of total product imports in both 1966 and 1967.

Data for the first half of 1968 showed imports running above the previous year's level ($547 million compared with $511 million for the same period in 1967). Imports of petroleum totaled an estimated $52 million, base metals $54 million, and manufactured fertilizers $4.0 million. Exports for the first half year were up significantly ($427 million compared with $386 million) with metalliferous ores and concentrates amounting to $50 million; copper ores and concentrates alone accounted for $38 million.

The United States and Japan continued to be the Philippines most important trading partners. Combined, they accounted in 1967 for 63 percent of product imports and 77 percent of exports. Japan, which took 34 percent of exports, was the destination for the largest part of the copper ore and concentrate (valued at $57 million), iron ore and concentrate ($14.5 million), and metallurgical-grade chromite ($2.9 million). In return, it supplied 29 percent of imports, including the largest part of iron and steel products, somewhat more than half of the nonferrous base metals, and the largest single portion of manufactured fertilizers. The United States, accounting for 34 percent of the imports and 43 percent of the exports, received the principal part of refractory-grade chromite and almost all of the gold.

Table 2.—Philippines: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965	1966	Principal destinations, 1966
METALS			
Chromite	618,804	536,844	United States 294,689; Japan 144,532.
Copper ore and concentrate	235,416	260,634	Japan 260,534.
Gold:			
Ore and concentrate [1]	2,827	NA	
Metal, unworked—troy ounces	40,565	259,873	All to United States.
Iron ore and concentrate—thousand tons	1,389	1,546	All to Japan.
Manganese ore and concentrate	59,988	64,826	Japan 63,825.
Mercury—76-pound flasks	2,205	2,066	United States 1,007; United Kingdom 810.
Molybdenum ore and concentrate	150	79	Japan 63.
Zinc ore and concentrate	3,910	2,475	All to United States.
MINERAL FUELS			
Petroleum, crude (reexports)—thousand 42-gallon barrels	29	-------	

NA Not available.
[1] Includes gold-and-silver bearing lead-copper concentrates.
Source: Department of Commerce and Industry, Bureau of the Census and Statistics. Foreign Trade Statistics of the Philippines, Manila, 1966 and 1968.

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Table 3.—Philippines: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965	1966	Principal sources, 1966
METALS			
Aluminum, metal, including alloys, all forms	5,223	7,252	United States 4,825; Japan 418.
Copper, metal, including alloys, all forms	r 5,000	4,567	Japan 3,854; United States 157.
Iron and steel:			
Scrap	10,999	6,379	United States 4,252.
Pig iron, including cast iron	14,555	12,905	Australia 8,253.
Ferroalloys	1,451	1,455	Norway 719; Japan 616.
Steel, primary forms and semimanufactures. thousand tons	530	454	Japan 383.
Lead, metal, including alloys, all forms	3,647	4,347	Australia 3,653.
Nickel, metal, including alloys, all forms	r 43	66	West Germany 21; Japan 18.
Tin, metal, including alloys, all forms. long tons	600	518	Malaya 503.
Titanium oxides	2,361	2,968	Australia 816; West Germany 786.
Zinc, metal, including alloys, all forms	11,496	16,393	Japan 8,469; Australia 6,212.
NONMETALS			
Abrasives	347	326	Netherlands 185.
Asbestos	1,288	1,730	Canada 853.
Cement	91,547	66,803	Taiwan 40,210.
Clays, kaolin	4,233	3,319	United States 1,081.
Diatomite	4,239	11,924	Japan 11,528.
Fertilizers:			
Crude, phosphatic	57,797	23,558	All from the United States.
Manufactured thousand tons	226	107	Japan 58.
Gypsum	25,935	64,568	Australia 39,048.
Pigments, mineral (lead and zinc based)	1,277	1,414	Netherlands 453; Australia 305.
Stone, dolomite	3,277	3,275	Japan 2,796.
Sulfur, elemental, all forms	19,039	558	West Germany 236; United States 208.
Talc	2,652	2,859	South Korea 1,285; Japan 896.
MINERAL FUELS			
Coke and semicoke	20,699	14,059	West Germany 5,700; Taiwan 4,055.
Petroleum:			
Crude thousand 42-gallon barrels	36,899	39,932	Indonesia 11,481; Saudi Arabia 6,979.
Refinery products:			
Gasoline do	565	2,031	United States 883.
Kerosine do	258	408	Japan 116.
Distillate fuel oil do	324	361	Japan 94.
Lubricants do	752	719	United States 407.
Other do	20	28	United States 6.
Total do	1,919	3,547	

r Revised.

Source: Department of Commerce and Industry, Bureau of the Census and Statistics. Foreign Trade Statistics of the Philippines, Manila, 1965 and 1966.

COMMODITY REVIEW

METALS

Chromite.—All Philippine chromite is mined for export. In 1968, 303,005 tons of refractory chromite valued at $5.8 million, and 136,172 tons of metallurgical chromite valued at $2.4 million were exported. Although output of refractory chromite increased about 6 percent in 1968, its outlook seemed uncertain. Largely in response to the accelerating trend toward replacing open hearth, chromite brick furnaces by oxygen converters employing higher temperatures refractories, U.S. steel producers —traditionally the largest consumers of Philippine refractory chromite—reduced their purchases for the third straight year. In addition, Benguet Consolidated, Inc., the sole refractory chromite producer, was believed to be experiencing some reserve difficulties at its Masinloc mine in west-central Luzon. Conversely, the future for metallurgical chromite appeared to be improving, even though production increased only about 2 percent in 1968. The Acoje Mining Co., Inc., virtually the country's only producer of metallurgical chromite, obtained from Japanese sources both a $800,000 loan to expand operations at its Zambales workings in west-central Luzon to 145,000 tons per annum, and a 4-year agreement to purchase 120,000 tons annually.

Copper.—In 1968, the rapidly growing copper mining sector easily exceeded the

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100,000-metric-ton level in mine copper output. Existing concentrators, already capable of producing 120,000 tons of contained copper per year, were undergoing expansion aimed at increasing capacity by another one-third by the early 1970's. Of the approximately 10 companies producing copper in 1968, the most important with their estimated mine-copper outputs in metric tons were as follows: Atlas Consolidated Mining and Development Corp. (41,900); Lepanto Consolidated Mining Co. (26,000); Marinduque Mining & Industrial Corp. (23,400); and Philex Mining Corp. (9,100).

Atlas Consolidated, which operates one of the largest Far Eastern copper mines at its Toledo workings on Cebu, raised production approximately 30 percent during the year as part of a continuing plan to bring annual output to 45,000 tons of mine copper. Milling capacity at Toledo was expanded to 21,500 tons of ore daily. A new hoisting arrangement for the mine shaft was completed at the underground Lutopan workings at Toledo. Output from Lepanto Consolidated's rich copper (and precious metal) Mankayan mine in north-central Luzon increased about 35 percent, even though the prolonged U.S. copper industry strike forced the company by mid-year to redirect its shipments of concentrate from the Takoma, Washington smelter of American Smelting and Refining Company to the Oroya, Peru smelter of Cerro de Pasco Corp.

While Marinduque Mining's total copper output remained almost the same in 1968 as in 1967, production from its two mines followed different courses. Output at the Bagacay open-cut copper-pyrite mine on Samar, which had risen sharply in 1967 as a result of the addition of new equipment, dropped about 27 percent to an estimated 6,200 tons. At the Sipalay open pit mine at Negros, milling capacity was being increased and production rose approximately 19 percent to an estimated 15,400 tons of mine copper. Overall plans at Sipalay are to raise output to 12,500 tons of ore daily by 1971 and to construct the Philippines second nonferrous smelter for treating ores from both Sipalay and Bagacay. This plant, designed to initially treat 250 tons a day of concentrates, will produce somewhat over 15,000 tons of copper annually as well as recover significant amounts of byproduct gold and silver. Related facilities will manufacture copper wire rods and bars and produce approximately 40,000 tons of sulfuric acid annually. Financing for the $25 million installation was reportedly being sought at yearend.

Philex Mining's plan to increase the annual capacity of its Tuba underground porphyry copper mine and mill in west-central Luzon to 10,000 tons of mine copper proceeded fairly well; production rose about 46 percent.

Two new projects were underway in 1968 which undoubtedly will greatly accelerate the growth of the Philippine copper industry. In the first, Black Mountain Inc. began work on an on-site smelter at its new Kennon mine in west-central Luzon. The mine, equipped with an underground three-stage crushing plant and a 4,000-ton-per-day-capacity conveyor belt to carry the sized ore to an aboveground mill, operated at 1,500 tons of ore per day at yearend 1968. The smelter is designed to process 2,500 tons per day of concentrate. Although no completion date has been set for this plant, equipment has been ordered from Japan and it will probably become the Philippines first nonferrous smelter. Meanwhile, mine output is to be shipped to Japan to the Nippon Mining Co., Ltd.

In the second, larger project, Marcopper Mining Corp., a joint venture of the Philippine Government (60 percent) and Placer Development Ltd. of Canada through its subsidiary Craigmont Mines Ltd. (40 percent), was working at Labo on Marinduque to develop a 90- to 100-million-ton reserve of 0.75 percent copper in a porphyry deposit. The stripping of overburden and construction of a 15,000-ton-per-day flotation mill with magnetite recovery units was proceeding; production is scheduled to begin in late 1969. An estimated two-thirds of the $60 million allocated for the project had already been spent by yearend 1968, and a 10-year contract was signed with Nippon Mining for annual delivery of concentrates containing 40,000 tons of copper beginning in 1970.

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Gold and Silver.—Gold output increased about 5 percent in 1968, whereas silver production rose approximately 13 percent. Benguet Consolidated, the largest producer of gold accounting for almost half of the 1968 total, actually experienced a 5 percent decline in output. This decline was in spite of the virtual completion during the year of a project to provide impounding facilities for tailings at its key mill in west-central Luzon. All of the major silver producers, however, enjoyed increases. Important mine producers of precious metals in 1968 with their preliminary reported outputs were as follows:

Company	Gold (troy ounces)			Silver (thousand troy ounces)		
	Primary	Secondary	Total	Primary	Secondary	Total
Atlas Consolidated Mining and Development Corp	---	27,789	27,789	---	153	153
Benguet Consolidated Inc	260,843	---	260,843	224	---	224
Lepanto Consolidated Mining Co	---	83,839	83,839	---	443	443
Marinduque Mining and Industrial Corp	---	10,000	10,000	---	646	646
Philex Mining Corp	---	37,084	37,084	---	54	54
Others	47,676	60,124	107,800	16	39	55
Total	308,519	218,836	527,355	240	1,335	1,575

Substantial revision of the Philippine gold subsidy program, which has been in effect since 1961, was proposed in late 1968. Under the present scheme, all gold must be sold to the Central Bank at $35 per troy ounce, with producers receiving a subsidy to compensate for the difference between this amount and the free market price. In 1968 the free market price allegedly reached as high as $69 per troy ounce. The principal change proposed has been modification of the subsidy paid to large mining companies for whom the production of gold is not of overwhelming importance.

Iron Ore.—All output of the Larap mine of Philippine Iron Mines, Inc., the largest producer of iron ore, went directly to a nearby pelletizing plant in 1968. The installation, which was taken over in 1967 by the Pellet Corp. of the Philippines (a Japanese-dominated concern) after several years of continual malfunctioning, appeared to be operating near yearend at its 750,000-ton-a-year capacity. Existing contracts with Philippine Iron guarantee ore deliveries through 1974. All pellet output goes to Kawasaki Steel Corp. facilities in Japan.

Iron and Steel.—Steady progress was made during the year in transforming the existing small steelworks at Iligan on Mindanao into a modern integrated steel plant. Until 1968, the only facilities at Iligan had been a scrap-based, 25-ton-per-charge electric-arc furnace, and single billet and merchant mills producing up to 40,000 tons annually of products. In October, however, Iligan Integrated Steel Mills Inc. began test operation of a 100,000-ton-per-year electrolytic tin-plating line. Uncoated steel sheets were supplied by Fuji Iron and Steel Co. Ltd. and Kawasaki Steel of Japan. A 400,000-ton-per-year cold rolling mill was due for completion in early 1969; construction of a hot rolling mill was reportedly underway. In 1972 a 1,500-ton-per-day blast furnace and at least one of two 50- to 60-ton-per-charge oxygen converters are to come on stream. As originally planned, about 640,000 tons of crude steel and 430,000 tons of rolled products are to be produced when the plant becomes fully operational. More recently, doubling of these capacities has been discussed. Indigenous limestone and some domestic iron ore are to be used; initially coke is to be imported.

In early 1968 Elizalde Iron and Steel Corporation, the Philippines largest tinplate producer with a processing capacity of 75,000 tons annually, began construction of a cold rolling mill at its plant near Manila on Luzon. Scheduled for completion in mid-1968, this reversing mill can roll up to 120,000 tons per year if required for Elizalde's adjacent electrolytic and hot-dipping lines.

Manganese.—Acoje Mining produced about 32,905 tons of manganese ore and

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33,138 tons of manganiferous ore at its Sierra Madre property in Isabella during 1968, mostly for export to Japan. Unless additional reserves are found, Acoje is preparing to withdraw from this property by early 1969.

Mercury.—The Philippines remained a significant world supplier of mercury in 1968. There was high-level demand in both domestic and foreign markets; prices ranged between $500 and $575 a flask during the year. The sole producer of Philippine mercury, Palawan Quicksilver Mines Inc., operated its four rotary kilns somewhat above their rated capacities and produced about 36 percent more mercury in 1968 than in 1967. Most of the exports went to Japan.

Nickel.—Development of the extensive nickeliferous laterite deposits moved forward rapidly in 1968. In July Marinduque Mining, representing an international consortium, signed an agreement with the Government's Surigao Mineral Reservation Board to exploit nickel reserves on Parcel 2 of the Reservation on Nonoc. Initial plans call for the erection of a pilot plant (in Canada) by Sherritt Gordon Mines Ltd. of Canada, followed by construction of a refinery with a first-stage annual capacity of 20,000 tons of nickel metal. Nanyo Bussan Co., Ltd., a Japanese trading company which provides two-thirds of the necessary $75 million development capital, plans to build the refinery and function thereafter as sales agent for the nickel in Japan. Longer range plans envision a 50-percent increase in nickel refining capacity and the establishment of an electric furnace to produce pig iron from residues. Total ore reserves are about 62 million tons, analyzing 1.34 percent nickel, 0.10 percent cobalt, and about 37 percent iron.

Atlas Consolidated obtained from its associate, A. Soriano and Co., rights to mine lateritic nickel-cobalt ore deposits on Mindanao and Palawan. The Mindanao deposit has estimated ore reserves of 110 million tons, assaying 1.27 percent nickel and 0.06 percent cobalt. Preliminary exploratory work on Palawan has shown 97 million tons of ore reserves analyzing 1.37 percent nickel and 0.10 percent cobalt.

NONMETALS

Cement.—Spurred by a boom in housing and an expansion program in highway construction, cement production rose to about 2.6 million metric tons in 1968, a 21-percent increase over 1967. Present annual cement production capacity is 3.3 million tons.

In 1968, three new cement plants, owned by Bacnotan Cement Industries, Hi-Koppers Cement Co., and Luzon Cement Corp., were completed. Two other plants were under construction. One is owned by Fortune Cement Corp. and the other by Continental Cement Corp. Construction was also underway for expansion of existing facilities at plants of Continental, the Universal Cement Co., Inc., and Marinduque Cement Co. At least five more plants are to be completed by 1972; these plants would bring total cement production to 8.5 million tons annually.

Fertilizers and Pyrite.—The fertilizer manufacturing industry slumped somewhat in 1968 owing to a slack demand and competition from Japanese imports. However, both Marinduque Mining and Atlas Consolidated, the two principal producers of pyrite for fertilizers, recorded new highs in output. Marinduque Mining produced about 91,000 tons from its Bagacay mine and Atlas Consolidated produced approximately 82,000 tons from various properties. In addition, Marinduque Mining ordered equipment for a new beneficiation plant to be erected at Bagacay. The installation, which was designed to treat 1,000 tons of pyrite ore daily, is scheduled to be completed in the latter part of 1969.

Atlas Fertilizer Corp., which produces nitrogenous, phosphatic, and mixed fertilizers, and Chemicals Industries of the Philippines, Inc., both increased capacities. The Maria Christiana Fertilizer Corporation (Marcelo) with a nitrogenous fertilizer plant on Mindanao completed plans for an ammonia plant on Luzon. Resins, Inc., was also reportedly planning a 200-ton-per-day urea plant near Manila.

Gypsum.—A 350-ton-per-day Onoda-type gypsum reprocessing plant was being built by Hitachi Shipbuilding and Engineering Co., Ltd. and Naigai Consultant Co., Ltd. of Japan for Esso Standard Fertilizer and Agricultural Chemical Co. It is expected to make the Philippines largely self-sufficient in gypsum.

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Perlite.—The first discovery of perlite in the Philippines was made in early 1968 near Legaspi on the southern tip of Luzon. The Philippine Bureau of Mines estimated the size of the deposit at 9.6 million tons. In the nearby Poliqui Bay area, another deposit was estimated to contain 30 million tons of perlite. Together, the Philippine discoveries may constitute one of the larger perlite reserves in the Far East. The Trinity Lodge Mining Corp. was established to mine the perlite by open pit methods and to process the ore for sale. Initially, the mined perlite may be exported, since there is presently no heavy demand for it in the Philippine construction industry.

Sulfur.—Benguet Consolidated announced early in 1968 that it would use $15 to $20 million of foreign funds for development of its 29-percent-grade sulfur deposit on Negros Island. More than 13,000 feet of diamond drilling has indicated 25 million tons of sulfur-bearing rock near Dumaquete susceptible to mining by open pit methods. During the year, facilities necessary for a first-stage production of 500 tons per day of high-grade sulfur were being constructed. Production cost is estimated at $26 per metric tons of sulfur, compared with the current export price of $50 to $60. At these cost-price levels, company officials estimate that $250 to $300 million could be expected in profits annually. A wholly owned subsidiary, Benguet Sulphur and Chemical Corp., was established by Benguet Consolidated to mine and refine the ore.

MINERAL FUELS

Petroleum.—Under Philippine Senate bill No. 676 introduced in 1968 and expecting passage in 1969, the Government would assume extensive control over the oil industry. A commission is to be instituted with authority to control internal petroleum product prices, costs of imported crude oil and product prices, and amounts of petroleum imports. It would have final authority over expansions of existing refineries, the licensing of new refineries, and the setting of permissible rates of return for refiners. The commission also would license service stations and distribution outlets, allegedly as a means of encouraging orderly competition. The prevention of discrimination against Philippine-owned tankers would be under its jurisdiction as well.

All petroleum needs continued to be met by imports. The estimated 60 million barrels of crude oil and petroleum products imported in 1968 bore a value of roughly $120 million, a serious drain on the country's foreign exchange. By yearend all exploration for domestic sources of crude oil had ceased, owing in part to a lack of favorable geological conditions for large reserves and uncertainty concerning the future legal status of concession rights.

At yearend 1968, Philippine refineries had a crude distillation capacity of approximately 180,000 barrels per day, at least 25 percent more than estimated consumption. Four refineries, all on Luzon, shared this capacity: The 60,000-barrel Batangas refinery of Caltex (Philippines) Inc., the 55,000-barrel Tabangao refinery of Shell Refining Company (Philippines) Inc., the 50,000-barrel Bataan refinery of Bataan Refining Corp., and the 15,000-barrel Rosario Cavite refinery of Filoil Refinery Corp.

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The Mineral Industry of Poland

By Bernadette Michalski [1]

The mineral industry continued to be a major contributor to the Nation's economy during 1968. The gross value of mineral and metal production was estimated at $2,900 million or 11 percent of the gross national income of approximately $26,340 million. Overall industrial growth rate was 9.3 percent; however, individual segments of the mineral industry registered growth rates far in excess of that figure.

Significant among the mineral industries were coal and sulfur, the output of which ranked Poland about fifth as a world producer of these two commodities. Ingot steel production based on imported ores and domestic fuels placed Poland ninth among steel producers. The country ranked eighth in world zinc production in 1968.

PRODUCTION

Production capacity for a number of mineral commodities was increased during the year, as the copper mines at Lubin, a zinc mine at Olkusz, and the Rzeszow gasfield were developed. New facilities were commissioned at the Ptock petroleum refinery and at the steelworks Lenin, Warszawa and Śrem. In most cases the new facilities were not commissioned until yearend and their full impact upon output will not be registered until 1969. Nonetheless, marked increases in 1968 production were registered for sulfur, natural gas, petroleum products, and fertilizers.

In addition to new capacity the mineral industry has been undergoing a modernization and mechanization effort. The results of some of these efforts are evident in the following table:

[1] Foreign mineral specialist, Division of International Activities.

Industry	1960	1967
Iron and steel:		
Number of blast furnaces	26	26
Number of open-hearth furnaces	93	94
Steel output per square meter of hearth per 24 hours, metric tons	5.7	7.1
Coal mining, bituminous:		
Number of underground mines	80	81
Number of shallow or surface mines	46	20
Share of total output extracted mechanically, percent	34	53
Share of total loading conducted mechanically, do.	28	62
Crude petroleum and natural gas production:		
Number of wells	3,182	3,152
Crude oil output, thousand metric tons	194	450
Natural gas output, thousand cubic feet	20,205	51,662
Crude oil and natural gas output per industrial worker per year [1], metric tons petroleum equivalent	135.4	443.6
Petroleum refining:		
Number of refineries	5	6
Crude oil processed per industrial worker, metric tons	362.1	1,045.6

[1] Natural gas converted to petroleum equivalent at the rate of 1,000 cubic meters of gas = 1 metric ton of petroleum equivalent.

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Table 1.—Poland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Metal, primary	47,800	47,300	55,200	92,400	93,500
Cadmium, metal including alloys, all forms •	425	440	430	440	440
Copper:					
Mine output, metal content •	14,500	15,100	16,100	16,500	17,000
Metal:					
Blister	24,000	27,000	27,000	27,000	28,000
Refined, including secondary	36,645	37,400	39,847	42,200	43,600
Iron and Steel:					
Iron ore and concentrate—thousand tons	2,680	2,862	3,054	3,077	3,050
Pig iron including blast furnace ferroalloys—do	5,643	5,760	5,856	6,581	6,839
Steel, ingots and castings—do	8,573	9,088	9,850	10,454	11,007
Steel, semimanufactures—do	6,203	6,638	7,122	7,593	7,827
Lead:					
Mine output, metal content	38,300	41,200	45,100	44,700	48,700
Metal, including secondary	41,501	41,386	48,487	44,800	42,000
Nickel:					
Mine output, metal content	1,205	1,101	•1,300	•1,500	•1,500
Silver•—thousand troy ounces	129	129	160	160	160
Zinc:					
Mine output, metal content	150,700	152,100	150,300	156,600	•158,000
Metal, refined, including secondary	186,900	190,400	193,000	196,000	202,500
NONMETALS					
Barite •	45,700	45,700	47,000	47,000	47,000
Cement, hydraulic—thousand tons	8,761	9,578	10,041	11,138	11,600
Feldspar •	26,700	26,700	28,000	28,000	28,000
Fertilizer materials:					
Crude (natural):					
Phosphate rock	89,000	93,000	•95,000	•95,000	•95,000
Manufactured:					
Nitrogenous:					
Gross weight—thousand tons	1,451	1,528	1,706	2,035	•2,600
Nitrogen content—do	359	394	462	594	759
Phosphatic:					
Gross weight—do	1,644	1,792	1,889	1,972	•2,200
P_2O_5 content—do	314	344	364	380	474
Gypsum and anhydrite:					
Calcined—do	156	158	156	153	NA
Crude •—do	760	762	760	755	NA
Lime (quicklime and hydrated lime)—do	2,173	2,260	2,401	2,358	•2,500
Magnesite, crude	38,000	42,000	•42,000	•45,000	NA
Pyrite and pyrrhotite (including cupreous):					
Gross weight •	240,000	240,000	240,000	240,000	240,000
Sulfur content •	91,000	91,000	91,000	91,000	91,000
Salt:					
Rock—thousand tons	660	674	762	830	969
Other—do	1,581	1,623	1,647	1,658	1,665
Sulfur, elemental:					
Frasch process—do	------	------	------	•230	329
Other native—do	295	431	477	•492	487
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural	203,800	241,000	304,300	349,200	NA
Coal:					
Bituminous—thousand tons	117,354	118,831	121,979	123,900	128,600
Lignite and brown—do	20,250	22,626	24,508	28,922	26,900
Coke, all types—do	14,931	15,196	15,256	15,200	15,700
Fuel briquets, all grades—do	999	949	936	901	NA
Gas, natural, marketed—million cubic feet	43,472	48,663	48,593	55,373	90,264
Peat—thousand tons	100	78	60	41	NA
Petroleum:					
Crude oil—do	282	339	400	450	475
Refinery products:					
Gasoline, aviation and motor—do	385	707	819	1,013	•1,400
Kerosine—do	16	31	20	19	•20
Other—do	1,532	3,146	3,273	3,644	•4,200

• Estimate. NA Not available.

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TRADE

Overall foreign trade approached equilibrium while mineral trade continued its pattern of increasing deficit balances as indicated in the following table.

	Value (million dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	565	2,272
1967	555	2,526
1968	p 660	2,860
Imports:		
1966	624	2,494
1967	671	2,645
1968	p 875	2,870

p Preliminary.
[1] Converted from Polish zloty (Zl) at the official exchange rate of Zl 1 = U.S.$0.25.

Expansion of the petroleum, steel, and aluminum industries, based on imported raw materials, was the major factor causing the 1968 mineral trade deficit. Crude petroleum imports increased by 58 percent over those of the previous year, pig iron by 36 percent and alumina by 17 percent.

About 66 percent of the total trade turnover by value was conducted with other Communist Economy (Comecon) nations. This figure, however, may be inflated as many commodities entering Communist nations trade channels are apparently priced above world market levels.

Poland has had limited success in expanding its export markets in hard currency nations. Although sulfur and semiprocessed metals were delivered in increasing amounts to the West, fuels contributed the bulk of mineral exports to the non-Communist world. One fifth of total coal exports (5 million tons) was delivered to European Free Trade Association (EFTA) countries in 1968. Nearly 1 million tons of coking coal, an increase of 30 percent over 1967 shipments, was shipped to Japan. Further attempts to increase exports to the non-Communist world can be anticipated as Poland's hard currency deficit mounts.

Table 2.—Poland: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Cadmium, metal including alloys, all forms	339	281	U.S.S.R. 171; West Germany 54.
Iron and steel:			
Iron ore and concentrate	19,032	19,000	United Kingdom 16,000.
Pig iron including cast iron	17,840	280,013	Japan 177,725; United Kingdom 45,953.
Ferroalloys	3,073	289	West Germany 148; India 60.
Semimanufactures	938,358	1,148,558	United States 131,000; Czechoslovakia 130,000; U.S.S.R. 89,000.
Lead, ore and concentrate	16,282	18,903	West Germany 17,886; France 1,017.
Zinc, metal including alloys, all forms	94,313	92,424	U.S.S.R. 25,925; Czechoslovakia 10,276; United States 9,628.
NONMETALS			
Cement	643,699	736,117	Spain 157,923; Ghana 116,307; Hungary 80,007; Czechoslovakia 72,256.
Clays:			
Bentonite	-------	168	Undisclosed.
Refractory	60,534	59,642	Hungary 22,163; Italy 17,557; Yugoslavia 8,356.
Fertilizer materials:			
Manufactured:			
Nitrogenous, thousand tons	42	85	India 50; Czechoslovakia 16.
Gypsum and plasters:			
Gypsum, do	423	417	Sweden 154; Denmark 95; Norway 64.
Plasters, do	31	31	Finland 20; Austria 7.
Lime	58,166	43,042	Czechoslovakia 22,628; Netherlands 19,149.
Pyrite (gross weight)	39,551	54,565	United Kingdom 30,859; Czechoslovakia 20,042.
Salt, excluding brines, thousand tons	120	85	Hungary 23; Sweden 20; Mali 13.
Sulfur, elemental, do	272	e 400	NA.
MINERAL FUELS AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous, thousand tons	22,407	24,029	U.S.S.R. 7,770; Denmark 3,062; East Germany 2,118.
Lignite and lignite briquets, do	5,060	3,706	All to East Germany.
Coke, do	2,358	2,344	East Germany 892; U.S.S.R. 685; Hungary 280.
Gas, manufactured, million cubic feet	454	425	All to East Germany.
Petroleum:			
Refinery products	518,683	672,710	West Germany 272,763; Austria 111,104; Norway 62,956.

e Estimate. NA Not available.

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Table 3.—Poland: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources in 1967
METALS			
Aluminum:			
Bauxite and concentrate	115,511	107,815	Mainly from Hungary.
Oxide and hydroxide	120,082	167,812	Hungary 110,011; United Kingdom 15,644.
Arsenic trioxide	490	601	Sweden 400; Belgium 181.
Bismuth, metal including alloys, all forms	60	105	United Kingdom 100.
Chromite	144,206	150,238	U.S.S.R. 74,857; Albania 38,887; Cuba 24,905.
Copper:			
Ore and concentrate	20,882	18,631	Chile 8,062; Italy 3,435; Morocco 3,055.
Metal, including alloys, all forms	36,463	37,698	United Kingdom 21,222; U.S.S.R. 4,405.
Iron and steel:			
Ore and concentrate—thousand tons	9,429	10,056	U.S.S.R. 8,594; Sweden 761; Brazil 336.
Pig iron, including cast iron—do	775	704	U.S.S.R. 692.
Ferroalloys	3,917	5,930	U.S.S.R. 3,917; Austria 744.
Steel, primary forms	983	-------	
Semimanufactures	750,678	900,905	U.S.S.R. 393,993; Czechoslovakia 179,828; East Germany 57,718.
Lead, metal including alloys, all forms	17,397	17,089	United Kingdom 5,690; U.S.S.R. 4,010; Yugoslavia 3,764.
Magnesium metal, including alloys, all forms	400	471	All from U.S.S.R.
Manganese:			
Ore and concentrate	397,572	354,025	U.S.S.R. 311,144; Cuba 37,989.
Oxides	3,859	4,550	U.S.S.R. 1,547; Morocco 1,404.
Mercury—76-pound flasks	8,180	10,123	United Kingdom 6,265; Netherlands 3,074.
Molybdenum:			
Ore and concentrate	248	158	Canada 69; France 51; United States 28.
Tin metal, including alloys, all forms.—long tons	3,421	3,171	United Kingdom 2,156; Netherlands 881.
Tungsten ore and concentrate	2,955	2,445	All from United Kingdom.
Zinc:			
Ore and concentrate	100,891	107,274	Canada 29,889; West Germany 15,580; U.S.S.R. 15,158.
Metal including alloys all forms	966	-------	
Other:			
Ores and concentrates	4,339	3,537	United Kingdom 3,101; Cuba 337.
NONMETALS			
Asbestos	42,360	42,632	U.S.S.R. 24,156; Canada 6,584.
Barite	9,885	26,501	Spain 5,685; Czechoslovakia 5,203; Yugoslavia 4,632; Rumania 4,028.
Cement	300,825	214,236	All from U.S.S.R.
Clays:			
Bentonite	3,846	4,233	Yugoslavia 3,013; Hungary 1,200.
Kaolin (china clay)	77,796	71,313	Czechoslovakia 46,169; United Kingdom 4,024.
Cryolite	4,127	4,421	U.S.S.R. 1,681; France 850; Italy 729.
Diatomite	937	1,272	Austria 669; Belgium 544.
Fertilizer materials:			
Crude:			
Phosphatic—thousand tons	630	435	All from U.S.S.R.
Manufactured:			
Nitrogenous—do	87	68	Czechoslovakia 61.
Phosphatic—do	767	695	Morocco 306; Tunisia 236.
Potassic—do	1,543	1,700	East Germany 1,183.
Fluorspar	40,214	80,442	East Germany 12,400; mainland China 8,545; North Korea 5,549; Bulgaria 3,948.
Graphite, natural	12,463	10,012	Czechoslovakia 7,227; U.S.S.R. 1,804.
Magnesite	154,691	104,147	Czechoslovakia 57,360; North Korea 24,193.
Mica, all forms	1,035	1,158	India 374; United Kingdom 323; Belgium 182.
Talc	14,733	10,271	North Korea 7,009; Austria 1,110.
MINERAL FUEL AND RELATED MATERIALS			
Coal and briquets:			
Anthracite and bituminous coal.—thousand tons	1,164	1,243	U.S.S.R. 892; East Germany 300.
Lignite and lignite briquets—do	480	223	All from East Germany.
Gas, hydrocarbon:			
Natural—million cubic feet	24,783	39,152	All from U.S.S.R.
Manufactured—do	90	116	All from East Germany.
Petroleum:			
Crude—thousand tons	3,347	3,608	All from U.S.S.R.
Refinery products—do	2,342	2,784	U.S.S.R. 1,765; Rumania 294.

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COMMODITY REVIEW

METALS

Aluminum.—Poland's second reduction plant, Konin, has been in operation since 1966 but has not achieved capacity production. Difficulties are apparently centered on inadequately trained personnel operating the highly sophisticated Péchiney equipment.

Bauxite supply has been assured by the renewal of a long-term trade agreement with Hungary which supplies this ore in exchange for aluminum metal. The agreement extends through 1975 and guarantees that mutual requirements for these commodities are met.

Copper.—Expansion of mining facilities continued at Lubin-Glogow basin. The mid-year opening of the Lubin and Polkowice mines increased the gross weight copper ore output to more than 3 million tons in 1968. The Legnica electrolytic refinery, expanded in 1967, operated at only 72 percent of its rated 60,000-ton capacity; nonetheless, a second electrolytic refinery, with a 40,000-ton annual capacity, was being built at Zukowice. This plant is scheduled for completion in March 1971.

Iron and Steel.—The industry continued to maintain a better than 5-percent growth rate in 1968. Increased output was mainly due to full use of existing capacities. Near yearend, several investment projects were realized. Among these were the Nova Huta slabbing-rolling mill, the Warszawa rolling mill, the Śrem iron foundry, and the pipe welding plant at Ferrum.

Zinc and Lead.—A new zinc deposit of unreported magnitude was discovered near Zawiercie in south-central Poland. Previous development activity has been centered principally in the Olkusz-Bolesxawiec area in southwest Poland and as a result, the Olkusz zinc-lead mine was opened at yearend. The mine is designed to produce 750,000 tons of ore annually.

In November 1968, the Imperial smelting furnace of the Miasteczko Slaskie zinc-lead combine was put into operation. Successful operation of this new furnace envisages a 10-percent increase in zinc and a 15-percent increase in lead output. This combine plans to install a second Imperial smelting Market desirability of Polish sulfur is enfurnace, but no decision has been announced as to when construction will begin. Nearly half of Poland's zinc metal output is exported almost equally between non-Communist and Communist nations.

NONMETALS

Cement.—Consumption requirements and export market demand for cement is expected to reach 18 million tons by 1975. During 1969–75, five new cement plants are scheduled to begin operation. The first of these plants, Chelm II, was under construction in 1968. Poland's 20 existing cement plants are all to be modernized with emphasis on automation and mechanization as well as broadening of product range.

Fertilizers.—The Pulawy fertilizer complex, including the newly operative nitric acid plant and ammonia nitrate plant, contributed 40 percent of the total nitrogenous fertilizer output in 1968. The complex, still under construction, is scheduled to produce 300 tons of ammonia daily by 1970. Other nitrogenous fertilizer plants under construction were the Kedzierzy and the Tarnow II. The domestic production of nitrogenous fertilizers adequately meets domestic requirements and provides an exportable surplus. Much of the requirement for phosphatic and potassic fertilizer is met through imports; however, Poland anticipates production of 950,000 tons of phosphatic fertilizers in 1969, satisfying about 70 percent of domestic consumption requirements.

During the year, the Tarnobrzeg superphosphate plant started production resulting in a 25-percent increase over 1967 in output of phosphatic fertilizer. The phosphorous fertilizer plant at Police will commence production in 1969. Plant capacity will be 230,000 tons of ammonium phosphate annually.

Sulfur.—An 82-percent increase in output over that of 1967 ranked Poland as the world's fifth largest sulfur producer in 1968. The marked increase in the 1967–68 production was attributable to the adoption of the Frasch process at the Grzybow and Jeziorko mines, which accounted for more than half of the 1968 production. Exports also increased to 950,000 tons in 1968, more than double the previous year figure.

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hanced by its total lack of arsenic, tellurium, and selenium.

Production in 1970 is now planned at 2.6 million tons, which apparently includes production from the Machow open-pit mine scheduled for production in 1969 at an annual capacity of 12 million tons of ore. The sulfur in this ore will be recovered by conventional floatation methods.

MINERAL FUELS

Poland's total fuel requirements have increased by about 4.5 percent annually since 1965, and an annual growth rate of 4.2 percent is projected for the period 1970. Coal continued as the nation's primary fuel source but at a decreasing level. The contribution of various fuels to the nation's energy balance in 1965 and projections for 1970 and 1975 is tabulated as follows in percent:

Type of fuel	1965	1970	1975
Coal, bituminous and lignite	69.8	64.2	60.0
Coke	12.6	12.1	11.5
Liquid fuels	6.9	10.4	13.5
Gaseous fuels	7.9	10.6	13.0
Natural gas	2.1	6.2	8.0
Other fuels	3.3	2.7	2.0
Total	100.0	100.0	100.0

Coal.—Poland's coal output continued to maintain a 3-percent annual growth rate. Within the last 10-year period, coal output has increased 34 million tons but the number of workers at the coal face has decreased 10 percent, indicating improved productivity. In 1968 more than 50 million tons of coal was mined by mechanical means compared with 19 million tons in 1963. The fully automated mine at Katowice started operation during the year. This mine will use new mining techniques and is expected to produce 15 tons per man-shift.

Natural Gas.—The more than 90,000 million cubic feet of natural gas produced in 1968 represented a 63-percent increase over the previous year with a further rise of 54 percent projected for 1969. The development of the Rzeszow gasfield in southeastern Poland was the basis for the increased output. Most of the gas was used by industry as fuel for open-hearth furnaces and as raw material for the chemical industry. In 1968 the chemical industry consumed about 21,000 million cubic feet of natural gas with a projected increase of 70,000 million cubic feet in 1969.

Petroleum.—The second distillation column at the Ptock refinery was operative in 1968, contributing to the 40-percent increase in petroleum product output and a projected 20-percent increase in 1969. The Soviet Union continued to pipe in more than 90 percent of the crude oil supply via the Friendship pipeline.

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The Mineral Industry of Portugal

By F. L. Klinger [1]

Output and exports of Portugal's mineral industry were close to the levels of 1967, and the industry's prospects for growth during the next few years seemed to be good. Significant mining developments were underway in iron ore, tungsten, and salt; the iron and steel works was being expanded; and a new petroleum refinery was almost completed. Exploration for precious metals, tin, uranium, and pyrite was continued, and offshore exploration for oil and gas was possible in 1969.

PRODUCTION

Preliminary statistics indicated that volume and value of mine and quarry output (excluding construction materials) in 1968 were slightly above the levels of 1967. This was due mainly to increased output of tungsten concentrates, pyrite, and salt, as production of several commodities, including precious metals and coal, declined.

In the manufacturing industries, the more significant changes were increases of 15 percent in rolled steel and 14 percent in nitrogenous fertilizers, and a 19-percent drop in output of ferrotungsten.

[1] Physical scientist, Division of International Activities.

Table 1.—Portugal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Antimony, mine output, metal content	12	11	4	23	50
Arsenic, white	372	186	194	252	e 200
Beryl concentrate, gross weight	18	40	12	14	104
Columbite-tantalite concentrates, gross weight	3	5	10	14	9
Copper:					
Mine output, metal content:					
In cupreous pyrites	4,119	3,684	3,468	3,471	e 3,450
In other ore and concentrate	167	114	186	139	122
In precipitate	79	64	81	53	50
Total	4,365	3,862	3,735	3,663	e 3,622
Metal, refined	3,392	3,778	3,939	3,857	3,889
Gold:					
Mine output, metal content—troy ounces	21,316	21,541	18,776	27,103	18,679
Metal—do	8,166	20,416	23,020	20,191	NA
Iron and steel:					
Iron ore and concentrate:					
Hematite and magnetite—thousand tons	172	165	139	143	149
Manganiferous—do	43	46	53	54	55
Pig iron—do	263	269	241	278	281
Ferroalloys, excluding blast furnace products:					
Ferromanganese and ferrosilicon	5,379	6,741	7,985	7,130	7,159
Ferrotungsten	327	218	245	370	299
Steel, ingots—thousand tons	250	273	r 258	r 302	313
Steel semimanufactures:					
Light sections—do	120	139	166	152	NA
Other—do	83	90	r 75	79	NA
Lead:					
Mine output, metal content	196	152	1,715	1,594	e r 2,400
Metal, refined	1,366	1,308	1,058	1,073	1,232
Manganese ore and concentrate, gross weight	6,995	7,765	8,607	9,832	9,663

See footnotes at end of table.

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Table 1.—Portugal: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS—Continued					
Silver:					
Mine output, metal content—troy ounces	48,773	r 93,204	354,558	356,789	• 300,000
Metal, including secondary—do	178,000	721,000	1,089,625	275,210	NA
Tin:					
Mine output, metal content—long tons	676	557	600	645	624
Metal—do	589	603	556	592	619
Titanium (ilmenite concentrate), gross weight	57	75	481	535	553
Tungsten; mine output, metal content	841	782	951	1,096	1,313
Uranium oxide (U_3O_8) produced •	18	38	42	95	95
Zinc, mine output, metal content	952	r 2,952	2,345	507	• 600
NONMETALS					
Asbestos	-------	r 48	r 10	52	102
Barite	348	3,308	1,016	316	160
Cement, hydraulic—thousand tons	1,622	1,680	1,720	1,821	1,861
Clays:					
Kaolin	38,293	40,394	34,066	37,209	40,369
Other	257,000	362,000	94,000	52,000	NA
Diatomite	2,002	2,627	3,488	3,908	3,512
Feldspar	11,170	8,296	r 23,540	30,321	21,239
Fertilizer materials, manufactured:					
Nitrogenous, gross weight—thousand tons	491	535	522	507	579
Phosphatic, gross weight—do	431	430	408	491	489
Mixed and unspecified—do	140	147	161	167	165
Total—do	1,062	1,112	1,091	1,165	1,233
Gypsum and anhydrite—do	65	81	113	104	NA
Lime (quicklime and hydrated lime)—do	166	160	182	201	192
Mica, all grades	NA	NA	1,601	1,657	• 1,600
Pyrite and pyrrhotite (including cupreous), gross weight:					
Noncupreous—thousand tons	195	293	228	528	553
Cupreous—do	412	323	330		
Total—do	607	616	558	528	553
Sulfur content—do	279	283	257	243	254
Quartz:					
Common quartz	24,000	7,910	23,278	60,545	57,318
Quartzite	8,000	191,000	191,000	276,000	NA
Salt:					
Rock—thousand tons	89	90	98	113	151
Marine—do	232	409	r 257	321	• 300
Stone, sand and gravel, n.e.s.:					
Stone:					
Calcareous:					
Dolomite	5,370	2,975	4,538	5,340	NA
Limestone, including marl and calcite—thousand tons	1,988	2,252	r 2,781	2,732	NA
Marble—do	56	49	144	181	NA
Other:					
Granite—do	211	734	998	2,042	NA
Slate—do	79	85	73	67	NA
Other—do	214	243	285	377	NA
Gravel—do	573	r 531	r 541	219	NA
Sand, not further described—do				769	NA
Sulfur, elemental, including sublimed	6,130	9,737	6,328	451	• 400
Talc	800	710	r 720	140	1,100
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite—thousand tons	444	428	420	443	397
Lignite—do	101	90	51	39	31
Coke, gas—do	10	13	r 10	10	• 10
Fuel briquets, all grades—do	41	34	38	37	30
Gas, manufactured—million cubic feet	3,143	3,228	3,330	3,622	3,810
Petroleum refinery products:					
Gasoline—thousand tons	379	391	399	407	403
Kerosine—do	184	199	185	191	203
Jet fuel—do	29	39	75	96	64
Distillate fuel oil—do	322	331	371	368	369
Residual fuel oil—do	570	596	567	619	609
Liquefied petroleum gases—do	46	45	39	34	42
Other—do	40	47	52	57	• 50
Total—do	1,570	1,648	1,688	1,772	• 1,740

• Estimate. r Revised. NA Not available.

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TRADE

Angolan diamonds remained the principal item in Portugal's crude mineral trade in 1968. Compared with 1967 levels the value of imports dropped slightly, to $40.3 million, while the value of exports of nonindustrial stones appeared to drop 36 percent to $28.6 million. Exports of tungsten concentrate, pyrite, and unworked building stone, the principal crude mineral products of continental Portugal, were valued at $12.5 million.

Fuels continued to account for more than one-third of mineral commodity imports in 1968 and were valued at about $87 million, followed by iron and steel ($48 million).

Values for mineral commodity trade and total commodity trade were as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	90	620
1967	103	701
1968 [1]	NA	737
Imports:		
1966	227	1,023
1967	233	1,059
1968 [1]	NA	1,046

NA Not available.
[1] Provisional figure.
Source: 1966–67 United Nations Statistical Office, New York.
1968 : Instituto Nacional de Estatistica (Lisbon). Boletim Mensal de Estatistica, (Monthly Bulletin of Statisics). No. 12; V. 40, No. 12; December 1968 annex V. No. 12, December 1968.

Table 2.—Portugal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum metal, including alloys, all forms	321	520	West Germany 330; Italy 49.
Arsenic trioxide, pentoxide, and acids	381	189	Spain 179.
Beryl ore and concentrate	10	28	All to United States.
Columbium and tantalum; Tantalum ore and concentrate.	30	25	NA.
Copper:			
Ore and concentrate	47	33	Sweden 30.
Matte	10	-------	
Metal, including alloys, all forms	1,788	1,033	Italy 320; United Kingdom 173.
Iron and steel:			
Ore and concentrate, including roasted pyrite	350	19	United Kingdom 17.
Metal:			
Scrap	11,748	13,508	Spain 10,365.
Pig iron, ferroalloys, and similar materials.	6,931	7,925	West Germany 3,620; United Kingdom 1,949.
Steel, primary forms	6,636	10,581	Angola 9,025.
Semimanufactures:			
Bars, rods, angles, shapes, sections	1,007	2,332	Angola 1,469.
Universals, plates and sheets	896	1,690	Angola 800.
Hoop and strip	88	84	NA.
Wire	369	8,633	United Kingdom 4,311; Morocco 2,893.
Tubes, pipes, and fittings	13,514	19,759	Angola 5,241; Spain 4,869; Mozambique 2,723; Cyprus 2,378.
Castings and forgings rough	105	239	Mainly to Africa.
Lead:			
Ore and concentrate	2,774	2,415	West Germany 1,655; Italy 750.
Oxides	84	89	Spain 25; Mozambique 25; Angola 24.
Metal, including alloys, all forms	162	208	Angola 124; Mozambique 44.
Magnesium metal, including alloys, all forms	NA	8	All to West Germany.
Manganese ore and concentrate	7,828	6,485	Mainly to West Europe.
Nickel metal, including alloys, all forms	19	43	Belgium-Luxembourg 16; United Kingdom 15.
Platinum-group metals and silver:			
Waste and sweepings:			
Silver and platinum.-----value thousands	$19	$8	West Germany $4; Belgium-Luxembourg $3.
Gold-----do	$29	$27	All to Belgium-Luxembourg.
Metals, including alloys:			
Platinum group-----troy ounces	1,132	1,692	West Germany 868; United Kingdom 759.
Silver-----do	161	2,249	Angola 1,264; Curacao 427.
Tin metal including alloys, all forms. long tons	111	389	United States 275; Mozambique 32.
Tungsten ore and concentrate	1,341	1,500	United Kingdom 461; Netherlands 441; United States 320.

See footnotes at end of table.

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Table 2.—Portugal: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destination, 1967
METALS—Continued			
Zinc:			
Ore and concentrate	5,686	985	All to France.
Oxide	79	104	Mozambique 52; Angola 49.
Metal, including alloys, all forms	242	288	Netherlands 131; Belgium-Luxembourg 50; Norway 37; Italy 31.
Other:			
Ore and concentrates:			
Of molybdenum, titanium, vanadium, and zirconium.	980	1,950	All to Spain.
Of base metals, n.e.s.	157	NA	NA.
Ash and residues containing nonferrous metals.	965	1,698	Belgium-Luxembourg 1,069.
NONMETALS			
Abrasives, natural, n.e.s.: Pumice, emery, natural corundum, diatomite, etc.	351	298	United Kingdom 122; Angola 82.
Asbestos	18	57	All to the United States.
Barite and witherite	995	6	Mozambique 3; Angola 2.
Cement	164,902	69,028	Spain 41,954; Guinea 13,637.
Chalk	85	121	Angola 107.
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Kaolin	2,435	2,440	Italy 2,100; Spain 210.
Other	1,257	2,586	Spain 1,720; Gibraltar 655.
Products:			
Refractory (including nonclay bricks)	798	2,555	Gibraltar 1,567; Angola 703.
Nonrefractory	20,398	17,803	Spain 4,957; Mozambique 1,503.
Diamond:			
Gem, not set or strung—value thousands	$37,054	$44,552	All to the United Kingdom.
Industrial—do	-------	$681	Do.
Feldspar	11,677	11,575	Italy 6,176; United Kingdom 1,835.
Fertilizer materials, manufactured:			
Nitrogenous	85,534	95,725	Turkey 23,459; Republic of South Africa 19,829; Syria 10,885.
Phosphatic	65,025	109,498	Nigeria 27,462; Bulgaria 20,274; Cyprus 15,866; Turkey 5,480.
Potassic	929	1,080	Angola 854.
Other, including mixed	24,003	19,829	Cyprus 8,083; Angola 4,566; Turkey 3,500.
Gypsum and plasters	387	210	Angola 86; Mozambique 75.
Lime	2,303	3,187	Spain 1,536; Mozambique 1,180.
Mica, crude, including splittings and waste	1,359	936	France 419; United Kingdom 270; Italy 111.
Pigments, mineral:			
Natural crude	113	69	Angola 25; Cape Verde Islands 18.
Iron oxides, processed	-------	44	Mozambique 23.
Pyrite (gross weight)	272,522	244,177	Belgium-Luxembourg 182,502; West Germany 43,495.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	121,937	105,648	Italy 67,427; West Germany 14,633.
Slate	8,396	9,856	Belgium-Luxembourg 3,240; France 2,785.
Granite and other	5,131	1,718	West Germany 733; Italy 719.
Worked:			
Slate	4,003	4,693	West Germany 1,247; United States 985.
Paving and flagstone	137,487	145,650	West Germany 57,920; Netherlands 24,162; Sweden 17,980; United Kingdom 17,259.
Marble and other	23,425	16,193	United States 7,483; France 2,745.
Gravel and crushed rock	1,964	3,356	Angola 1,550; Mozambique 1,351.
Quartz and quartzite	19,923	25,276	Italy 13,200; West Germany 5,450; Norway 4,252.
Sand, not metal bearing	32,579	21,453	Gibraltar 21,435.
Sulfur, elemental, all forms	947	1,467	Cyprus 772; Mozambique 400.
Other nonmetals, n.e.s.	1,103	156	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	48	306	Guinea 250.
Coal and coke, including briquets	113	154	Cape Verde Islands 110.
Petroleum refinery products [1]:			
Gasoline (including natural)	r 41,669	14,068	Guinea 6,185; Netherlands 4,604.
Kerosine and jet fuel	r 88,715	101,501	Netherlands 73,734; Bahamas 15,554.
Distillate fuel oil	r 17,800	10,825	Guinea 7,314.
Residual fuel oil	r 31,481	16,067	Belgium-Luxembourg 15,867.
Lubricants	r 5,154	6,339	Angola 4,301; Mozambique 1,474.
Liquefied petroleum gases	491	2,217	NA.
Other	88	312	NA.
Total refinery products	185,398	151,329	

r Revised. NA Not available.
[1] Excluding bunkers.

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Table 3.—Portugal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	4,379	2,905	France 2,405; Guyana 500.
Oxide and hydroxide	533	690	West Germany 390; France 224.
Metal, including alloys:			
Scrap	61	59	United Kingdom 36.
Unwrought	849	620	United Kingdom 379; France 146.
Semimanufactures	8,144	7,908	Austria 1,652; West Germany 1,316; France 1,118; United Kingdom 923.
Chromium:			
Chromite	119	60	Netherlands 39.
Oxide and hydroxide	87	123	West Germany 48; United Kingdom 38.
Copper metal, including alloys:			
Scrap	119	76	Mozambique 30; Cape Verde Islands 15.
Unwrought:			
Blister	2,581	1,537	Zambia 1,526.
Refined, unalloyed	3,842	3,933	Belgium-Luxembourg 840; Canada 839.
Master alloys	14	38	United Kingdom 36.
Semimanufactures	6,836	6,051	United Kingdom 2,256; Italy 1,025; West Germany 757; France 702.
Gold metal, unworked or partly worked. troy ounces	791	2,959	United Kingdom 1,612; United States 1,158.
Iron and steel:			
Ore and concentrate, including roasted pyrite.	57,123	43,136	Brazil 42,573.
Metal:			
Scrap	4,314	4,573	United Kingdom 1,282; Gibraltar 748.
Pig iron, ferroalloys, and similar materials.	4,284	2,599	United Kingdom 1,214; Netherlands 660.
Steel, primary forms	23,136	4,045	West Germany 3,090.
Semimanufactures:			
Bars, rods, angles, shapes, sections	62,521	46,724	West Germany 15,249; Belgium-Luxembourg 9,309; France 5,279.
Universals, plates and sheets:			
Heavy, medium, and light plates and sheets, uncoated.	124,112	118,950	West Germany 42,829; France 30,333; United Kingdom 24,873.
Tinned plates and sheets	63,517	45,646	United Kingdom 14,798; France 12,140.
Other coated plates and sheets	13,300	15,369	Belgium-Luxembourg 7,772.
Hoop and strip	35,111	25,976	Belgium-Luxembourg 8,363; France 6,639.
Rails and accessories	3,590	8,053	France 3,441; West Germany 1,978.
Wire	14,253	18,691	United Kingdom 6,415; Belgium-Luxembourg 5,615; West Germany 3,662.
Tubes, pipes, and fittings	12,544	14,284	West Germany 7,723; France 2,719.
Castings and forgings, rough	509	569	West Germany 315.
Lead:			
Oxides	13	46	United Kingdom 29; Spain 10.
Metal, including alloys:			
Scrap	133	89	Gibraltar 42; Angola 13; Mozambique 11.
Unwrought and semimanufactures	8,455	7,647	Mexico 3,354 Republic of South Africa 1,827; Peru 1,115.
Magnesium metal, including alloys, all forms.	6	2	United States 1.
Manganese:			
Ore and concentrate	308	379	United Kingdom 244; West Germany 55.
Oxides	37	64	United Kingdom 39; Netherlands 21.
Mercury 76 pound flasks	763	209	Spain 200.
Molybdenum metal, including alloys, all forms. kilograms	5,100	400	West Germany, Netherlands, and United Kingdom, each 100.
Nickel metal, including alloys, all forms	301	253	United Kingdom 124; West Germany 101.
Platinum group metals and silver, including alloys:			
Platinum-group troy ounces	3,632	18,776	United Kingdom 6,944; West Germany 6,602; France 5,188.
Silver thousand troy ounces	436	982	West Germany 566; United Kingdom 392.
Tin:			
Oxides long tons	16	12	United Kingdom 6; Austria 5.
Metal, including alloys, all forms do	17	29	United Kingdom 18; West Germany 7.
Titanium:			
Ore and concentrate [1]	558	349	Australia 296.
Oxides	2,433	2,636	United Kingdom 1,081; West Germany 587.

See footnotes at end of table.

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Table 3.—Portugal: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Zinc:			
Oxides	286	198	West Germany 80; Belgium-Luxembourg 48.
Metals, including alloys:			
Unwrought	5,086	6,252	Spain 2,026; Belgium-Luxembourg 1,777.
Semimanufactures	285	308	West Germany 160; Belgium-Luxembourg 79.
Other: Ore and concentrate of base metals, n.e.s.	159	133	NA.
NONMETALS			
Abrasives, natural n.e.s.:			
Pumice, emery, natural corundum, etc.	610	548	Netherlands 260; Italy 184.
Dust and powder of—value thousands	$6	$32	NA.
precious and semiprecious stone.			
Asbestos	4,097	4,301	Canada 1,801; Republic of South Africa 1,252.
Barite and witherite	235	297	West Germany 264.
Cement	915	1,950	France 515; Angola 495.
Chalk	1,818	2,026	Belgium-Luxembourg 1,014; France 980.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.:			
Bentonite	2,056	1,562	Morocco 560; Italy 376.
Kaolin (china clay)	453	986	United Kingdom 792; United States 161.
Other	3,801	2,330	United Kingdom 1,404.
Products:			
Refractory (including nonclay bricks).	7,695	5,481	West Germany 1,532; Austria 664.
Nonrefractory	882	538	NA.
Cryolite and chiolite	33	50	All from Denmark.
Diamond, gem, not set or strung—value thousands	$42,431	$42,021	Angola $41,904.
Diatomite and other infusorial earths	1,597	2,055	United States 1,160; Italy 362.
Feldspar	946	852	United Kingdom 395; West Germany 260.
Fertilizer materials:			
Crude:			
Nitrogenous	150	3,616	Chile 3,520; West Germany 86.
Phosphatic	223,934	296,761	Morocco 294,683; Mexico 930.
Manufactured:			
Nitrogenous	1,076	1,114	West Germany 1,010.
Phosphatic	11,157	11,292	Belgium-Luxembourg 10,013.
Potassic	23,127	30,271	Spain 30,269.
Other, including mixed	20,757	21,823	West Germany 18,748.
Graphite, natural	144	158	Norway 68; West Germany 58.
Gypsum and plasters	15,633	14,331	Morocco 14,246.
Magnesite	1,033	367	Netherlands 235.
Mica, crude, including splittings and waste	87	92	Norway 49; United Kingdom 23.
Pigments, mineral:			
Natural, crude	176	73	France 42; West Germany 16.
Iron oxides, processed	1,307	1,213	Spain 600; West Germany 493.
Salt and brines	20,650	11,040	Cape Verde Islands 8,150.
Stone, sand and gravel:			
Dimension stone, crude and partly worked.	r 332	698	Angola 616; West Germany 78.
Dolomite, chiefly refractory grade	3,480	3,321	Italy 2,244; Norway 576; Spain 438.
Flint and crushed rock	594	739	Belgium-Luxembourg 646.
Quartz and quartzite	1,858	2,052	Belgium-Luxembourg 1,785.
Sand, excluding metal bearing	5,200	4,331	Netherlands 2.131.
Sulfur, elemental, all forms	34,274	18,814	France 17,313.
Talc, steatite, soapstone, pyrophyllite	1,926	2,319	Norway 838; France 832; Italy 379.
Other nonmetals, crude, n.e.s	1,975	5,554	Cape Verde Islands 5,227.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,238	1,606	Belgium-Luxembourg 1,473.
Carbon black	4,500	5,113	France 2,115; United States 917.
Coal, all grades, including briquets—thousand tons	470	390	Poland 248; United Kingdom 64; United States 53.
Coke and semicoke—do	290	298	Netherlands 115; West Germany 54; Italy 52; United Kingdom 50.

See footnotes at end of table.

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Table 3.—Portugal: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS —Continued				
Petroleum:				
Crude and partly refined.	thousand tons	1,557	1,751	Iran 988; Bahrain 486.
Refinery products:				
Gasoline	do	102	132	Venezuela 48; Netherlands Antilles 26.
Kerosine and jet fuel	do	26	25	Netherlands Antilles 21.
Distillate fuel oil	do	323	392	Netherlands Antilles 106; Italy 73; Iran 63; Venezuela 58.
Residual fuel oil	do	288	300	Mozambique 83; Angola 58; Netherlands 39.
Lubricants	do	49	51	United Kingdom 24; Netherlands 12.
Liquefied petroleum gases	do	105	150	France 114; Netherlands 16.
Other:	do	59	•65	Spain 28.
Mineral tar and other coal, petroleum, or gas derived crude chemicals.		7,994	7,436	Netherlands 1,940; United Kingdom 1,611; United States 1,270.

r Revised. • Estimate. NA Not available.
1 Includes vanadium and zirconium ores.

COMMODITY REVIEW

METALS

Gold and Silver.—The Mouros mine of Minas de Jalles, Ltda., continued to account for all the reported mine output of gold in 1968, in addition to about 15 percent of total mine silver production. The average silver content of concentrate declined to about 16 ounces per ton, compared with 20 to 24 ounces in 1966 and 1967. After removal of arsenic by Minas do Pintor Ltda., at a plant south of Porto, the concentrates were smelted at the Barreiro works of Companhia União Fabril (CUF), near Lisbon.

Production of silver in lead and zinc concentrates at the Terramonte mine of Minas de Terramonte Ltda. (MITEL) apparently declined in 1968, to an estimated 250,000 ounces compared with 300,000 ounces in 1967. The quantity of ore milled (81,500 tons) was about the same, but most concentrate produced in 1968 was a lead-zinc type containing about 75 ounces silver per ton. In 1967, the bulk of production was made up by a lead concentrate containing 100 to 125 ounces silver per ton.

Proved ore reserves at the Terramonte mine were reported in 1966 as 400,000 tons, containing 4.16 percent lead, 3.35 percent zinc, and 5.6 ounces silver per ton. Other metals include antimony (up to 0.7 percent in galena), cadmium (up to 0.3 percent in blende), and smaller amounts of arsenic and copper.

Iron and Steel.—*Iron Ore.*—Commercial production of iron ore from the Moncorvo deposits in Bragança was expected to begin in late 1970. The development company, Exploracão e Desenvolvimento Mineiro de Moncorvo Ltda. (Minacorvo), reportedly planned to begin construction of mine and plant facilities early in 1969 for production of 2 million tons of pelletized concentrate annually. In a pilot plant operated since early 1967, the company has produced daily about 60 tons of flotation concentrates, containing 64 percent iron and 0.3 percent phosphorus, from 120 tons of crude ore containing 42 percent iron and 0.3 to 0.5 percent phosphorus. Particle size of the concentrate was 80 percent (minus) 44 microns. Proved crude ore reserves at Moncorvo were reported to be approximately 200 million tons, and an additional 400 million tons was probable.

Steel.—Facilities of the Seixal steelworks were being expanded in 1968, to include a rail- and heavy- section mill, cold-rolling mill, tinning and galvanizing lines, and a new oxygen plant, all scheduled for completion in 1969. Ironmaking and steelmaking capacity were scheduled to double by 1973.

Tungsten and Tin.—Production and exports of tungsten in concentrates increased by 20 percent in 1968. The increase was mainly due to expanding production at the Panasqueira mine of Beralt Tin and Wolfram Ltd. The company's expansion

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program, costing an estimated $1.6 million, is designed to increase the annual output of tungsten concentrates to 2,200 tons by yearend 1970. Production in 1968 was 1,419 tons.

The Beralt firm also planned to invest about $330,000 in exploration and development work on the Ribeira tin deposit in Bragança. If sufficient ore reserves are proved, the mine will be equipped to produce about 300 tons of ore per day. The Ribeira property was reported to have produced 4,000 tons of tin-and-tungsten concentrates, prior to its closure in 1966.

Recoverable reserves of tungsten and tin ores in Portugal were estimated by Portuguese sources in 1965 at 60,000 tons of wolframite and 40,000 tons of cassiterite.

NONMETALS

Pyrite and Sulfur.—Increased output of pyrite in 1968 was accompanied by a rise in production of sulfuric acid, to 440,000 tons. Exports of pyrite remained at the 1967 level. An estimated 60 percent of the pyrite was produced at Aljustrel and the remainder was produced at Louzal. Exploration for pyrite was being conducted between Aljustrel and Louzal, by a subsidiary of CUF, and in the vicinity of the depleted San Domingos deposits by a subsidiary of Cominco Ltd. of Canada.

Salt.—While the rising output of rock salt was due mainly to increased production from the Matacaes deposits north of Lisbon, development of the large deposits at Loulé, northwest of Faro, was continued in 1968. The Loulé deposit was opened by two circular shafts, about 13 feet in diameter and 830 feet apart, sunk to a depth of 740 feet. Underground, a large haulage gallery was being driven to connect the shafts. If adequate export markets can be found (the salt contains about 5 percent impurities), the rate of production may reach 2,000 tons of salt daily by 1970. Reserves are very large.

MINERAL FUELS

Solid Fuels.—Domestic output of coal and lignite continued to be used mainly by thermal powerplants and the cement industry. The latter industry was also the principal consumer of imported coal, as the iron and steel industry relied principally on imported coke. According to the Third Economic Development Plan, Portugal hoped to double its imports of coal by 1971, and to increase domestic production of coal to 480,000 tons annually. An investment of $15 million was also proposed, for development of lignite resources and construction of a pithead powerplant at Rio Maior.

Petroleum.—*Exploration.*—On November 6 the Government authorized opening of bids for oil and gas exploration on the Continental Shelf, but it was stated that the bidding would be limited to those firms which had already expressed interest in such exploration. However, qualifying firms were not identified and no concessions had been awarded by yearend. Under the applicable Decree Law, No. 47,973, the Ministry of Economy can award concessions either on the basis of public bidding, or by private negotiations with selected firms. The shelf area, comprising about 16,000 square kilometers, is divided into approximately 200 blocks. A concession may include up to 12 blocks, will be valid for 6 years and renewable for 40 years. Multiple-concession awards are permitted. A surface tax of $7 per square kilometer is payable in advance for the initial 6 year period, and royalties on oil or gas production will be at least 11 percent of the gross value at the wellhead.

Refining.—Portugal's second petroleum refinery, under construction near Porto by Foster Wheeler, Inc., of New York, was expected to come on stream by yearend 1969. The plant will have an annual processing capacity of about 1.8 million tons of crude oil, slightly less than the country's other refinery near Lisbon. Both plants are owned by Sociedade Anónima Concessionária da Refinação de Petróleos em Portugal (SACOR).

Inland consumption of petroleum products in 1968 totaled 2.75 million tons, about 11 percent more than in 1967. Fuel oils comprised about 50 percent of the total quantity.

Uranium and Nuclear Energy.—In 1968 the Government had no definite plans to build a nuclear powerplant in Portugal, but considering the country's uranium resources and the estimated increase in demand for electric power in the 1970's, it was possible that 1,000 to 2,000 megawatts of nuclear generating capacity might be installed after 1975. Under the new 5-year

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economic development plan, the Junta de Energia Nuclear (JEN) was expected to spend $1.25 million for nuclear studies in the electricity sector. The plan also proposed an investment of $3.5 million for prospecting and exploitation of uranium deposits in Portugal.

Proved reserves of uranium oxide in Portugal, extractable at a cost of less than $10 per pound U_3O_8 totaled 8,500 metric tons. Most Portuguese crude ore contains 0.15 to 0.20 percent U_3O_8, and reserves are concentrated in the districts of Viseu (Urgeiriça), Castelo Branco (Nisa), and Guarda districts. At least two concentrating plants were operated in 1968: The main plant, at the Urgeiriça mine, had an output capacity of 118 tons U_3O_8 annually; the other, a mobile plant processing ore from small mines in Guarda, had an annual capacity of about 14 tons U_3O_8. Part of the output is stockpiled by JEN, and part is exported, usually to France. In 1968, France imported 663 tons of uranium ore and concentrate from Portugal, compared with 244 tons in 1967.

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The Mineral Industry of Rumania

By Joseph B. Huvos [1] and Roman V. Sondermayer [1]

Petroleum production continued to be Rumania's most important contribution to world mineral supplies in 1968. Again the nation's output of crude oil ranked only second after that of the U.S.S.R. among European producers. Production of 13.3 million tons of crude oil was equivalent to about 4.2 percent of the crude output of the U.S.S.R., and nearly 1 percent of world production. Exploration yielded new crude oil reserves that were barely adequate to compensate for the decline in reserves occasioned by the production from existing fields.

Besides crude oil, Rumania produced manganese ore, cement, pyrites, and salt, each in quantities of about 1 percent of world production. These products are, however, important to the domestic economy only.

The supply-demand situation for basic minerals remained unchanged although continued efforts were made to develop the country's resources in accordance with the goals set by the 1965–70 5-year plan. Extensive exploration was carried out and the metal smelting and manufacturing base was expanded. Nonetheless, the domestic output of metals could not cover internal demand.

The mineral industry contributed about 19 percent of the 1968 social product [2] of the country of slightly over $18 billion. Approximately 230,000 persons, about one-seventh of the total labor force, were employed in the mineral industry. Thus a greater share of the social product was contributed by the mineral industry than was indicated by its share of the total labor force. This resulted primarily from the greater efficiency of the petroleum industry. In other parts of the mineral industry the social product-to-employment ratio was less advantageous.

The mineral commodity trade of Rumania was modest by world standards, except for petroleum. Exports of refined petroleum products were in excess of 6 million tons. About two-thirds of all exports went to the U.S.S.R. and other Communist nations. The majority of imports, consisting mostly of iron ore, high-rank coals, and metallurgical coke, came from the U.S.S.R.

During 1968, the most important developments in the minerals industry were the commissioning of an oxygen converter plant and a slabbing mill at the Galati steel works and the beginning of the construction of a hot strip mill. At the Hunedoara combine, a blooming mill was commissioned. At Săsar a new ore beneficiation plant was also commissioned.

PRODUCTION

Production in the oil industry, the most modern sector of Rumania's mineral industry, increased only modestly in 1968. The necessity to exploit increasingly deeper structures was one of the principal causes for the slow progress of the industry. Rumanian drilling and workover rigs and production equipment were used in most operations, but Soviet-made turbo drills were employed for directional drilling in shallow, hard formations. Secondary recovery and hydraulic fracturing techniques were increasingly used.

In the nonpetroleum sector, efforts were made to increase production by mine mechanization. However, these efforts were only partly successful and at yearend many of Rumania's underground mines were still not mechanized.

[1] Foreign mineral specialist, Division of International Activities.

[2] As in other Communist countries of East Europe, Rumania does not report its gross national product (value of all final goods and services produced) but rather publishes a figure for the social product, which generally excludes all services and defense.

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Table 1.—Rumania: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Aluminum:					
Bauxite [e]	7,000	[r] 12,000	[r] 15,000	15,000	20,000
Metal and alloys	-------	22,795	46,851	52,801	76,274
Iron and steel:					
Iron ore—thousand tons	1,932	2,479	2,681	2,796	[e] 2,564
Pig iron—do	1,924	2,019	2,198	2,456	2,992
Steel ingots and castings—do	3,039	3,426	3,670	4,088	4,751
Rolled products except pipe—do	2,200	2,347	2,585	2,908	3,393
Pipe—do	552	586	630	651	[e] 692
Manganese ore (manganese content)	27,100	31,400	27,900	28,000	28,000
Mercury—76-pound flasks	194	191	190	190	[e] 203
Lead (smelter) [e]	12,700	15,000	40,000	40,000	[e] 40,000
Silver [e]—thousand troy ounces	643	643	750	800	800
NONMETALS					
Barite	NA	45,000	[e] 50,000	55,000	[e] 55,000
Bentonite	NA	90,000	[e] 100,000	110,000	[e] 120,000
Cement—thousand tons	4,752	5,405	5,886	6,338	7,026
Fertilizer materials:					
Nitrogenous (nitrogen content)	107,981	166,307	264,236	NA	NA
Phosphatic (P_2O_5 content)	111,323	126,465	155,112	NA	NA
Kaolin	NA	35,000	[e] 40,000	50,000	[e] 50,000
Lime—thousand tons	1,040	1,027	1,047	1,050	1,050
Pyrites (gross weight)—do	409	[e] 410	[e] 360	[e] 360	[e] 360
Salt—do	1,809	2,016	2,046	2,100	[e] 2,100
Sulfuric acid (monohydrate)—do	350	360	619	679	773
Talc—do	[e] 100	115	[e] 120	130	[e] 130
MINERAL FUELS					
Carbon black	35,394	36,704	38,288	52,473	54,873
Coal:					
Bituminous including anthracite—thousand tons	5,892	6,036	6,310	NA	NA
Brown—do	569	598	638	NA	NA
Lignite—do	4,662	5,461	6,503	NA	NA
Coke (metallurgical)—do	1,145	1,135	1,103	1,131	[e] 1,128
Natural gas [2]—million cubic feet	426,073	480,179	497,196	559,525	774,923
Petroleum:					
Crude—thousand tons	12,395	12,571	12,825	13,206	13,285
Refinery products:					
Gasoline—do	2,500	2,458	2,349	2,295	[e] 2,429
Kerosine—do	1,100	965	920	[r] 923	[e] 969
Gas oil—do	3,200	3,600	3,746	4,025	[e] 4,112
Fuel oil—do	3,831	3,773	3,952	3,946	[e] 3,415
Lubricants—do	448	483	496	500	[e] 500
Asphalt—do	321	341	370	400	[e] 400

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to listed commodities, Rumania produces antimony, chromite, copper, gold, molybdenum, zinc, asbestos, feldspar, gypsum, and mica, but quantitative data on production are not available.

[2] From 1965 includes associated gas.

TRADE

Rumanian publications did not report on the trade in mineral commodities by destination and origin; only general trade information was available. Foreign trade in minerals was subject to overall economic programing and was as always a State monopoly. Rumania's principal trade partners were again the Communist countries.

Efforts continued to increase trade with non-Communist countries, particularly in the acquisition of mining equipment and technology. Petroleum products constituted the bulk of Rumania's exports. The value of petroleum products exported to the non-Communist countries was about $72 million in 1966, the latest year for which data are available. High-rank coals and metals were the principal mineral commodities imported. Mineral trade with the United States was again minimal in 1968. High-rank coal, phosphate ore, and iron ore came mainly from the Soviet Union.

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Table 2.—Rumania: Exports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966		1967	
	Total	To U.S.S.R.	Total	To U.S.S.R.
METALS				
Iron and steel:				
Steel ingots	NA	93,100	NA	NA
Primary forms for rerolling and rolled products	444,500	r 211,200	259,200	95,400
Pipe	251,100	207,600	243,700	204,700
Manganese ore	48,500	----------	59,600	NA
Zinc, unwrought	NA	2,400	243,700	300
NONMETALS				
Barite	NA	16,400	NA	19,700
Cement, thousand tons	1,636	----------	1,369	----------
Salt	429,800	----------	396,500	----------
MINERAL FUELS				
Bitumen (Including natural)	69,700	----------	57,500	----------
Carbon black	17,700	----------	24,600	NA
Natural gas, million cubic feet	r 7,000	----------	7,000	----------
Petroleum refinery products:				
Gasoline	1,181,100	648,100	957,300	445,400
Kerosine	276,900	r 45,000	215,400	10,800
Diesel oil, thousand tons	1,950	116	2,092	152
Fuel oil, do	1,960	37	1,790	11
Lubricants	274,100	119,900	371,300	120,700
Paraffin	20,700	10,000	24,700	8,000
Petroleum coke	36,900	----------	45,500	NA

r Revised. NA Not available.
[1] Compiled from official trade statistics of the U.S.S.R. Data for the U.S.S.R. are Soviet import statistics published in Vneshnaya Torgovlya SSSR za god 1967 (Foreign Trade of the U.S.S.R. for 1967), Moscow, 1967.

Table 3.—Rumania: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966		1967	
	Total	From U.S.S.R.	Total	From U.S.S.R.
METALS				
Aluminum:				
Ingots	NA	600	NA	400
Semimanufactures [2]	NA	1,685	NA	736
Copper:				
Unwrought	NA	4,200	NA	4,100
Semimanufactures [2]	NA	1,287	NA	1,678
Iron and steel:				
Iron ore, thousand tons	2,854	2,428	3,360	2,670
Pig iron, do	NA	342	NA	384
Ferroalloys, do	51	57	69	65
Rolled products (except pipe), do	1,187	829	1,286	690
Pipe, do	82	20	98	23
NONMETALS				
Asbestos	NA	6,700	NA	7,200
Cryolite	NA	200	NA	500
Fertilizers:				
Apatite concentrate (P_2O_5 content)[3]	207,300	487,000	219,600	401,000
Potassic fertilizers (K_2O content)	21,900	----------	14,800	NA
Nitrogenous fertilizers (N content)	100	----------	300	NA
Refractories, all kinds	62,400	24,800	NA	16,800
Sulfur	NA	2,700	NA	2,000
MINERAL FUELS				
Coal:				
Bituminous	722,800	358,000	793,200	399,000
Coke, metallurgical, thousand tons	1,102	592	1,089	551
Petroleum refinery products:				
Lubricants	NA	400	NA	600

r Revised. NA Not Available.
[1] Compiled from official trade statistics of the U.S.S.R. Published in Vneshnaya Torgovlya SSSR, za god 1967 (Foreign Trade of the U.S.S.R. for 1967), Moscow, 1967.
[2] Alloys included.
[3] Figures for U.S.S.R. show gross weight.

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COMMODITY REVIEW

METALS

Aluminum.—During the year Rumania's first aluminum plant, situated in Slatina, the capacity of which had been increased in 1967 to 50,000 tons, reached its design capacity. It started to produce an aluminum alloy for the machine building industry, with good high-temperature strength and corrosion resistance properties. It is understood that it is planned to increase the capacity of this plant to 75,000 tons of aluminum per year.

The production of bauxite and alumina increased further, but it seems that the large expenditures made on the development of more adequate sources of low-grade bauxite and its beneficiation did not yield the results expected.

Rumania's main bauxite deposits are located near the Padurea Craiului Hills and at Dobresti near Chistag, where the discovery of rich new deposits estimated to contain reserves exceeding 250,000 tons was reported. The alumina plant at Oradea reached a monthly production of 15,000 tons after its capacity was doubled by the commissioning of a new calcining furnace in May 1968. Most of the bauxite used in the plant was imported from Yugoslavia and imports are expected to reach 150,000 tons in 1969.

Work started on building a carbon products plant for electrodes at the Slatina aluminum works. The plant will produce 26,100 tons of graphite electrodes and paste for aluminum electrolysis, steel mills, alkali-chloride electrolysis, and furnace linings. The new aluminum fluoride section of the chemical plant in Nâvodari, commissioned in January, will produce 3,000 tons per year for the Slatina aluminum combine.

Copper.—The second phase of the modernization and expansion of the Bălan mine, which will double ore production, started during 1968. The working facilities include a 360-meter shaft, three mining faces, and a flotation line. In Bălan, this second mine, near the sources of the Olt River, is said to have a nominal capacity of 650,000 tons of ore annually. The flotation plant is to be expanded to a daily capacity of 1,500 tons of ore.

The mining complex at Fundu-Moldovei in the Suceava region was commissioned, and an ore flotation plant was built. This mine and the development at Leşul Ursului will quadruple copper production in the Suceava Region by 1970.

Further copper deposits have been discovered at Moldova Nouă in the south of the Banat.

Iron and Steel.—Rumania continued to develop its iron and steel industry during the year. While exploration for additional iron ore was vigorously pursued, domestic ore provided only about one-half of consumption, and substantial amounts of iron ore had to be imported. During 1967 the development of the Gehlar East iron ore mines had been completed and output in the first year reached 80,000 tons of ore. The ore mined is processed at the Teliuc plant.

Development of the Galaţi steel complex was also continued. The converter plant, built and equipped with a 150-ton basic oxygen type converter by West German interests, was commissioned in June as was a slabbing mill complex, built and equipped by the Soviet Government. The slabbing mill has a first-stage capacity of 2.5 million tons and a second-stage capacity of 4 million. Work was also started on the construction of a hot strip mill. The Galaţi combine is designed for the production of sheets and strips 1 to 15 millimeters thick. Its capacity is to be about 5 million tons of steel per year.

At Hunedoara, the largest Rumanian iron and steel plant, the major event was the commissioning of the 1,300-millimeter blooming mill, with a capacity of 3 million tons per year. The electric furnaces of the Hunedoara combine are producing more than 100 varieties of alloy steel.

At Cîmpia Turzii, the Industria Sîrmei had a second 280,000-ton-per-year wire mill under construction for the production of wires from 5 to 14 millimeters in diameter.

Lead and Zinc.—In 1968 a new section was being built at the Copşa Mică Chemical Lead and Zinc Complex, in 1967 where 50,000 tons of lead from the Imperial Smelting Corporation process will be refined by electrolysis.

The sulfuric acid plant also situated there has a capacity of 100,000 tons per year. At Săsar a new ore preparation plant was commissioned, the second largest in

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Maramureş County. It has a processing capacity of 2,700 tons of ore per 24 hour day and is to be supplied with complex ores from the Săsar, Ilba, and Nistru mines.

NONMETALS

Barite.—In 1968, the mining operation at Rumania's largest barite deposit (90 percent barite content), near Ostra, in the northern Moldova, was expanded and modernized. Construction of an ore dressing plant is planned for 1970, when the output of the plant should be increased to about 120,000 tons of barite concentrate per year.

Dolomite.—In 1968, a mine was developed at Craciuneasă in the Poiana Rusca Mountains for the production of metallurgical dolomite. The mine will produce approximately 400,000 tons of this material annually.

Fertilizers.—In 1968 Rumania produced about 2 million tons of chemical fertilizers. With the commissioning of new production capacities at the combines in Tîrgu Mureş Turnu Magurele, and Craiova, the short supply of ammonium nitrate was apparently solved in 1968. The Tîrgu Mureş combine will supply more than 450,000 tons of ammonium nitrate per year to agriculture. The production capacity of the complex fertilizer plant of the combine in Turnu Magurele is being doubled. The urea plant of the nitrogen fertilizer combine in Craiova, which will have an annual capacity of 300,000 tons, was commissioned. Four more urea plants with a combined capacity of about 900,000 tons of nitrogen fertilizer per year will also be built. The installation of equipment for a 300,000-ton-per-year nitric acid plant was also completed at Craiova.

Work started on the expansion of the new sulfuric acid section in Năvodori. There will also be two production lines for phosphoric acid, a phosphorite granulating plant and a highly productive superphosphate granulating unit. These projects will double the plant's current production capacity.

Salt.—In 1968, a new production sector was opened at the salt mine in Slanic. Annual output will total approximately 600,000 tons, twice current production. Preparations have started in Harghita County for the exploitation of a new salt deposit reportedly containing reserves exceeding 5 million tons.

MINERAL FUELS

Coal.—In 1968 the output of low-rank coals was increased. A deficiency in high-rank coals persisted and substantial imports were therefore needed to cover the demand. The opening of new mines and the modernization of the existing ones continued—the more important activity being in the Rovinari and the Gorj basins.

The mines of the Gorj coal basin are expected to produce 5.5 million tons of lignite annually, bringing yearly output to 17 million tons. In the Rovinari basin assembly of new excavating equipment at the opencast lignite mine at Petergea was begun. This mine will have an annual production capacity of 1,350,000 tons. In the near future the Rovinari basin will produce approximately 8.5 million tons of lignite annually.

A new 500-meter-deep shaft was being driven at the Livizeni coal mine in the Jiu valley, which in its final stage will supply 1,200,000 tons of coal annually to industry. Mines will be opened at Lupoaia and Rosiuţa in the Lotru coal basin, and when completed, annual production capacity in the basin will be almost 3 million tons. Work has started at Petrila to develop a new coal deposit. This section will have 10 large-capacity coal faces and will produce annually more than 600,000 tons of coal. In the Jiu valley a new coal mine was being developed at Barbateni, which will be linked underground to the Lupeni coal mine. Twelve large-capacity coal faces were commissioned in 1968 at Aninoasa and annual output was expected to exceed 350,000 tons. A new opencast lignite mine with an annual production of 300,000 tons was opened at Racosul de Sus, Sf. Gheorghe Rayon. According to plans for energy production, the lignite produced will be used primarily for the production of electric power.

Petroleum and Natural Gas.—During 1968, about 17 percent of all industrial investment in Rumania was devoted to the petroleum industry. Deep drilling with domestic equipment, secondary recovery, and the construction of additional refining capacity with emphasis on production of petrochemicals were the highlights of the

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industry in 1968. The output of domestic crude increased only slightly. Although Rumania consumed only about one-half its crude oil output, it was a net importer of crude in 1968. The excess over domestic needs was processed for export in Rumania's refineries whose capacity considerably exceeds local demand for products.

Arrangements were made for importing over the next 10 years 11 million tons of crude from Venezuela and 9 million tons from Saudi Arabia. Iranian and Libyan crude was also imported. It has become increasingly necessary to begin to explore deeper structures, which has increased the cost of drilling and the production of crude.

Rumania's newest oil bearing area of the Videle district has increased its production rapidly. The area was said to produce 30 percent of Rumania's total crude oil output. During 1968, a new oil well drilling record was established at Bratesti near Ploiesti, with a depth of 5,280 meters.

During the last 5 years the annual increase in crude production was 6.8 percent, but the average growth rate of refining capacity was 10 percent. The tendency was towards the construction of larger, more economical, and automated refining plants, having capacities of 1 to 3 million tons each, and the modernization and merger of older plants. Some refineries are designed to produce petrochemical feedstock. A new diesel oil refining unit achieved its design parameters of 400,000 tons of diesel oil per year. A plant complex was under construction at Braz for the production of petrochemicals. Operations will start in 1969 and the complex will have a yearly output of 420,000 tons of petrochemicals. The natural gas processing plants at Moineşti, Modîrzău, and Poiana Rusca were modernized in 1968. The condensation products of these plants will be used in a process for raising the octane number of premium gasolines.

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The Mineral Industry of Sierra Leone

By E. Shekarchi [1]

The mining industry of Sierra Leone is only about 35 years old but has become one of the most important segments of the country's economy. In recent years, it has provided the major contribution to the country's economic expansion, with products of the mining industry accounting for 80 percent of total export value. Diamonds are now the largest single export item, and iron ore, bauxite, and titanium minerals are becoming extremely important as foreign exchange earners. Total gross national product (GNP), in current prices, was given provisionally at about $380 million.[2] According to estimates made in 1968 by the U.S. Agency for International Development (AID), the total population is about 2.5 million with a 1.5-percent annual growth.

The National Reformation Council, which seized control of Sierra Leone in March 1967, was itself overthrown on April 18, 1968. Within a month, power was duly handed over to a national government with civilian rule. There was a feeling of greater confidence in Sierra Leone with the return of civilian rule which was reflected in increasing trading activity and in better diamond sales to the official buying agents.

The World Bank granted a loan of $3.9 million to the Sierra Leone Electricity Corp. in mid-1968. A 6,600-kilowatt diesel electric generating unit will be installed at the King Town power station at Freetown, which itself was built in 1964 with the help of a World Bank loan of $3.8 million.

The British Navy's Ocean Survey ship arrived in Freetown in November 1968 to start a 3½-month hydrological survey of the harbor and Sherbro River in order to bring existing charts up to date. Some of the mining companies, particularly those producing titanium minerals, use the Sherbro River to ship ore to major ports.

Table 1.—Sierra Leone: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968 p
METALS					
Bauxite---thousand metric tons	153	207	272	342	350
Gold---troy ounces	49	-------	-------	--------	--------
Iron ore---thousand metric tons	1,993	2,144	2,304	2,098	3,000
Titanium minerals---metric tons	-------	-------	-------	25,141	26,000
NONMETALS					
Diamond:					
Gem---thousand carats	• 585	658	629	• 560	560
Industrial---do	• 878	804	888	• 840	850
Total---do	1,463	1,462	1,462	1,400	1,410

• Estimate. p Preliminary.

PRODUCTION AND TRADE

Preliminary data in 1968 indicated that production of iron ore, as well as titanium minerals and bauxite, increased to a significant level, while diamond production followed the same pattern as in the last 5 years. Diamonds were a significant exchange earning commodity for the nation.

[1] Foreign mineral specialist, Division of International Activities.

[2] Where necessary, values have been converted from Leones (Le) to U.S. dollars at the rate of Le 1=US$1.20.

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The value of mineral exports in 1966, the most recent year for which data are available, show diamonds valued at about $37 million, followed by iron ore at approximately $11 million. All other exports were below $1 million. The import values in 1966 were as follows: Metals, $3 million; nonmetals, about $2 million; and fuels, approximately $6.7 million. The importance of mineral exports in the country's economy is illustrated by the relationship of mineral trade to total trade during 1965–66 as follows:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total trade	
Exports:			
1965	• 75.8	88.5	85.6
1966	• 49.9	59.2	84.3
Imports:			
1965	14.9	107.8	13.8
1966	11.4	91.3	12.5
Trade balance:			
1965	• +60.9	−19.3	XX
1966	• +38.5	−32.1	XX

• Estimate.
XX Not applicable.

Table 2.—Sierra Leone: Exports of mineral commodities

Commodity		1965	1966	Principal destinations, 1966
	METALS			
Bauxite	thousand metric tons	176	244	Switzerland 143; Netherlands 80.
Iron ore:				
Concentrate	do	2,088	2,110	Netherlands 826; West Germany 621; Italy 340; United Kingdom 315.
Fines	do	246	107	All to Netherlands.
Total	do	2,334	2,217	
Ferromax [1]	metric tons	174	1,157	West Germany 679; Netherlands 315.
	NONMETALS			
Diamond, crude, unworked	thousand carats	1,525	1,338	All to United Kingdom.
	MINERAL FUELS			
Petroleum refinery products (reexports):				
Residual fuel oil.	thousand 42-gallon barrels	1,229	NA	

NA Not available.
[1] Tradename for specularite largely for pigment use.

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Table 3.—Sierra Leone: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965	1966	Principal sources, 1966
METALS [1]			
Aluminum	67	171	United States 80; United Kingdom 59.
Copper	60	693	United Kingdom 682.
Iron and steel:			
Ingots and other primary forms	19	--	
Semimanufactures	14,218	13,840	Japan 4,414; Belgium 2,422; Luxembourg 1,482.
Lead	44	45	Belgium 22; United Kingdom 17.
Platinum troy ounces	64	--	
Silver do	--	2,149	All from United Kingdom.
Tin long tons	10	1,221	Hong Kong 1,188.
Zinc	--	2	All from United Kingdom.
Ore and scrap, n.e.s	1	--	
Nonferrous metals, n.e.s	2	7	Hungary 6.
NONMETALS			
Abrasive materials	43	--	
Cement and lime	28,072	34,907	United Kingdom 11,961; Poland 7,808; West Germany 5,279; Norway 5,073; Israel 4,064.
Clay construction materials	925	319	United Kingdom 139; West Germany 80; Italy 59.
Fertilizer materials:			
Mineral	33	31	United Kingdom 30.
Manufactured	968	2,782	Netherlands 2,126.
Salt	6,991	10,003	United Kingdom 8,702.
Sodium hydroxide	168	566	United Kingdom 298; United States 240.
Stone, dimension	109	NA	
Stone, sand and gravel	47,668	42,108	Poland 21,398; Italy 10,412; Israel 10,262.
Nonmetallic minerals, n.e.s	131	132	Italy 81; India 41.
MINERAL FUELS			
Coal, coke, briquets	4,135	NA	
Gas, natural and manufactured (butane)	108	231	Netherlands 118; United Kingdom 55; Senegal 36.
Petroleum:			
Crude and partly refined 42-gallon barrels	22	--	
Refinery products:			
Gasoline thousand 42-gallon barrels	250	228	Netherlands Antilles 123; Italy 56; Trinidad and Tobago 24.
Kerosine do	78	80	Netherlands Antilles 36; Italy 15; Trinidad and Tobago 14.
Jet fuel do	66	24	Netherlands Antilles 15; Italy 9.
Distillate fuel oil do	1,365	1,103	Netherlands Antilles 394; Netherlands 240; Aden 105.
Residual fuel oil do	184	67	Netherlands 45; Argentina 17.
Lubricating oils do	16	23	United Kingdom 10; United States 6.
Asphalt and others do	26	17	United Kingdom 7; Spain 5.
Total do	1,985	1,542	
Tar, mineral	95	121	All from United Kingdom.

r Revised. NA Not available.
[1] Unwrought and semimanufactures, including alloys, unless otherwise specified.

COMMODITY REVIEW

METALS

Bauxite.—Sierra Leone Ore & Development Co., a subsidiary of Suisse Aluminium Industrie AG, expanded its production in 1968 to a new high of about 350,000 tons. The new aluminum-product fabrication plant, which the company was considering establishing in Freetown, remained in the planning stage, and no action was taken in 1968.

Iron Ore.—It was announced early in 1968 that, following talks in Tokyo, the Sierra Leone Development Co. Ltd. (DELCO) had signed a contract to supply iron ore to three Japanese steel mills. The contract called for deliveries totaling 400,000 tons between April 1968 and June 1969 and the annual shipment of 1.1 million tons per year for the following 10 years. The contract will entail considerable ex-

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pansion at both the Marampa mine and the port of Pepel. The development program will include dredging, improved ship handling and stocking facilities, as well as the installation of faster loading machinery.

At the port of Pepel, through which most of the company's iron ore is exported, ships of up to 90,000 deadweight tons, as opposed to the present 35,000- to 40,000-ton limit, will be loaded at an hourly rate of 4,000 tons. Completion of the renovations reportedly will be in mid-1969.

Owing to the Japanese contract and to the fact that DELCO is also selling on the open market (principally to Netherlands, West Germany, and Italy), production of iron ore reached 3 million tons in 1968. The ore, which averages 64 to 65 percent iron oxide, is from Marampa mine. This mine has been in operation since 1932 and is expected to produce for at least another 30 years.

Titanium Minerals.—The mine of Sherbro Minerals Ltd., an international company jointly owned by British Titan Products Ltd. and PPG Industries, Inc., which was officially opened in February 1967, ran into difficulty in December 1967 when one of the large hydraulic dredges was flooded and grounded. This handicap, however, was overcome by refloating of the hydraulic dredge in mid-1968 and the company resumed production. Following this, the company further negotiated to develop and modernize its mining and processing facilities.

The titanium minerals mined by Sherbro Minerals Ltd. occur in alluvial deposits, a rare, if not unique, mode of occurrence for a rutile and ilmenite orebody. The rated capacity of the plant is 100,000 tons of rutile per year, but there already are plans for increasing production as soon as the initial difficulties are overcome. A typical deposit contains the following, in percent: 36.8 rutile; 28.1 ilmenite; 19.7 zircon; 10.3 garnet; 3.4 quartz; and 1.4 monazite.

The deposits are mined mainly by a suction dredge which was built particularly for the project. The extraction and mining process consists of three distinct stages. In the first stage of the process, ore material is sucked up and the first separation is made by equipment mounted on the dredge. The resultant concentrate is pumped to a wet plant for further concentration. The second stage is in the wet plant where feed is largely heavy minerals like zircon, ilmenite, garnet, and ilmenite sands, which are recovered by gravity methods. The concentrate from the second stage is transferred to the dry plant, where it passes through a series of magnetic and electrostatic separators to produce final separation.

Because of the nature of the deposits and the occasional hardpan encountered, it has been found necessary to blast ahead of the dredge in some places to loosen the laterite cap and also to cut down on wear of the dredge's cutting edge.

The company, when in full operation (100,000 tons per year), will contribute almost 30 percent of current world production of rutile.

NONMETALS

Diamond.—In February 1968, the National Reformation Council (NRC) issued a decree to further tighten security in the diamond mining area. In essence, the decree warned any individual not indigenous to the area and anyone found in the area who does not have a government permit is liable to arrest without warrant. Exceptions to the rule are those working for the Civilian Rule Committee, medical doctors, lawyers, and journalists. This regulation, so far, has been successful in limiting ineligible miners.

In December 1968, the Diamond Corporation of West Africa Ltd. (DICOR) and the Sierra Leone Government agreed to a revision of the existing contract, "Alluvial Diamond Mining Scheme," under which DICOR is sole marketer and exporter of diamonds produced. The new terms of the agreement call for DICOR to pay the Government an annual lump sum of $396,000 for the rights and, in addition, to forego the 1 percent service fee (on diamond purchases) normally paid by the Government to DICOR for its management of the Government Diamond Office (GDO). Based on the 1968 estimated purchases by GDO, this meant a savings of approximately $288,000 for the Government of Sierra Leone, or a total gain of about $684,000 per year.

An increase in the price of rough gem diamonds marketed by the Central Selling Organization in London for the various diamond producers came into effect during September 1968. The increase varies according to the quality and size of the stone

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but will have the effect of an overall increase of 2.5 percent.

The GDO announced at the end of 1968 that the value of diamonds purchased during the year was the highest ($30.5 million) since the establishment of the office in 1959.

Diamond purchases during 1968 increased approximately 9.7 percent over the previous (1964) record. Comparative figures for 1967 and 1968 were as follows:

	1967	1968
Carats	759,513	863,804
Export values	$26,209,967	$30,521,978

MINERAL FUELS

Petroleum.—In April 1966, the Government of Sierra Leone signed agreements with Nissho Ltd. of Tokyo, Japan, and Haifa Refineries Ltd. of Haifa, Israel, to finance and manage a 10,000-barrel-per-day oil refinery. Ground breaking for the refinery at Kissy took place in March 1967. The construction of the refinery was completed by the end of 1968, but due to the questionability of the refinery's financial viability after a feasibility study, the Sierra Leone Government sought partnership from five internationally known oil companies (British Petroleum Ltd., Shell Oil Co., Mobil Oil Corp., Texaco Inc., and Agip Inc.) to operate the refinery and start test runs immediately. In January 1969, the five petroleum companies signed an agreement with the Sierra Leone Government giving the Government 50 percent of the shares in the refinery and the five petroleum companies the other 50 percent. It was also agreed that British Petroleum would manage the refinery on behalf of the Sierra Leone Government and the other shareholders. The 10,000-barrel-per-day refinery will produce regular and premium gasoline, aviation turbine kerosine, kerosine for domestic use, diesel fuel, and fuel for bunkers.

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The Mineral Industry of the Republic of South Africa

By Walter C. Woodmansee [1] [2]

South Africa's mineral industry in 1968 was characterized by continued growth in most sectors. Mines producing a number of metallic and nonmetallic mineral commodities were undergoing expansion and new mines were under development. The country's first aluminum, nickel, platinum, and zinc refineries were planned or under construction, and the only electrolytic copper refinery—that of Palabora Mining Co., Ltd.—reached full rated capacity. The iron and steel industry was in the process of increasing capacity, and a major new steelworks was planned by the Government-controlled South African Iron and Steel Industrial Corp. (ISCOR). Cement, fertilizers, and chemical plant capacities were under marked expansion. In the petroleum sector, large-scale offshore exploration began as the entire coastline was under lease to international companies and consortia.

The mineral industry was again a vital element in South Africa's continuing economic growth. In 1968 the mining sector (exclusive of platinum and uranium, data for which are not available) contributed the equivalent of $1.9 billion,[3] or 13.6 percent, to a gross national product (GNP) which attained the equivalent of $14 billion[4] (current prices) for the first time. This compares with mining's contribution of $1.8 billion to a GNP of $13.2 billion during 1967. Regarding the mineral industry as a whole, including value added by metallic ore and nonmetallic mineral processing and also the petroleum industry, sufficient data are not available for an accurate estimate of total value during 1968. In 1967, statistics including value of nonmetal and metal manufactured goods indicate a total value of $3.7 billion, or nearly 28 percent of the GNP for that year. Although manufacturing continued to exceed mining in this respect, primary mineral production was more important as an earner of foreign exchange.

Mining and metallurgical research continued at a rapid pace. The Chamber of Mines Research Laboratory reported development of a prototype rock-cutting machine which would eliminate blasting and, by reducing costs, perhaps extend mine life at many gold mines. The machine cuts slots in waste rock above and below the "reef band," permitting ore zone extraction with a minimum of dilution. It was tested under normal mining conditions, reportedly with favorable results. Reduced costs from the use of this machine may increase the maximum economic depth of gold mining to as much as 5,000 meters.

In March the Minister of Finance, in a budget speech, informed the mining industry that the equivalent of $115 million would be available to subsidize gold mines for 8 years under the Gold Mines Assistance Act, 1968. Mines qualifying for assistance are those that operated at a loss or with reducing profit margins, where profit does not exceed 8.838 percent of working revenue. Qualified mines may also be granted tax credits according to a

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[1] Physical scientist, Division of International Activities.

[2] Roderick G. Murchison, Regional Minerals Officer, U.S. Consulate General, Johannesburg, made substantial contributions to this chapter through State Department Airgram A–140, Industrial Outlook Report—Minerals (South Africa), 1968, and other official dispatches during the year.

[3] Where necessary, values have been converted from South African Rands (R) at a rate of R1=$1.40.

[4] U.S. Embassy, Pretoria. State Department Airgram A–77, May 6, 1969, p. 1a.

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specific formula. At yearend 22 mines had applied for assistance and 16 had been approved. The Act, which met with the approval of all elements of the gold-mining industry, will permit a lower cutoff grade for ore mined and extend the mine life of marginal operations.

Table 1.—Republic of South Africa: Average number of persons employed in mineral industry, 1968

Sector	Employees	
	White	Nonwhite
MINING		
Asbestos	952	17,351
Chromite	203	3,798
Copper	2,204	8,864
Coal and coke	7,846	70,715
Diamond	3,463	16,731
Gold	41,313	377,554
Iron ore	1,032	6,208
Manganese	533	7,558
Quarries, including salt	1,967	20,058
Other mines	3,770	42,392
Subtotal	63,283	571,229
PROCESSING		
Basic metals	26,200	36,700
Nonmetallic mineral products	14,000	69,100
Chemicals and chemical products	18,200	38,500
Total	121,683	715,529

Source: Republic of South Africa, Department of Mines, Mining Statistics, 1968.

PRODUCTION

The index of mineral production increased sharply early in the year, as the mining sector expanded output to meet greater demand for most mineral commodities, and then maintained a fairly steady level for the balance of the year. In terms of value, output of the mining sector was about 6 percent higher than in 1967, including an increase in gold production of 2 percent. Estimated value of mineral output, excluding platinum and uranium, was as follows:

Commodity	Value (thousands)	
	1967	1968
Gold	$1,075,337	$1,097,164
Silver	4,951	7,335
Diamond (sales)	83,032	105,805
Ores and nonmetallic minerals:		
Local sales	238,004	281,800
Exports	400,699	420,014
Total	1,802,023	1,912,118

Gold and diamond continued to dominate the mining scene in 1968. South Africa's gold output was about 76 percent of total non-Communist world output during the year. However, major flooding of the West Driefontein gold mine, an important gold producer, late in the year was a serious threat to the industry, but curtailment of production there was more than offset by the opening of new mines. The diamond industry had record sales and profits. Copper, platinum and iron ore also made major contributions in 1968. Expectation of greater demand for nuclear power sparked interest in recovery of uranium from gold mine dumps and slimes and the exploitation of low-grade deposits by more efficient extraction. Increased sales of iron ore, asbestos, coal, platinum, and minerals for the building industry were also reflected in the rise in value of minerals produced.

In the petroleum sector, output from the Republic's four refineries increased 31 percent in 1967, the latest year for which these data were available. At yearend estimated total crude capacity of these refineries was 165,000 barrels per day. In addition, the Government-owned South African Coal, Oil and Gas Corp. (SASOL) operated at an estimated rate of 5,000 barrels per day (1.8 million barrels per year), producing oil from coal distillation.

Details on production and value in the mineral-processing field are incomplete

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for 1968 but presumably would indicate improvement in most sectors. Value of output in the major sectors during 1967 was as follows:

	Value (thousands)
Fertilizers	$103,617
Chemicals and chemical products	98,508
Nonmetallic mineral products	317,617
Basic metals	591,536
Metal products	767,971
Total	1,879,249

Table 2.—Republic of South Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum, unwrought and semimanufactures	5,224	5,797	12,067	9,454	•11,000
Antimony, concentrate	21,312	20,548	18,417	20,159	27,372
Beryllium, beryl concentrate, 11–12 percent BeO	137	48	21	104	308
Bismuth, concentrate—kilograms	127	200	263	r 54	3,629
Chromium, chromite, gross weight:					
More than 48 percent Cr_2O_3	26,752	30,977	26,248	35,178	69,485
44 to 48 percent Cr_2O_3	641,823	668,483	691,701	r 781,270	758,477
Less than 44 percent Cr_2O_3	180,971	242,650	342,987	r 332,607	324,768
Total	849,546	942,110	1,060,936	r 1,149,055	1,152,730
Copper, metal:					
Blister and refined r	59,491	60,455	124,661	127,535	128,232
Castings, including alloys	18,224	28,290	45,275	48,928	• 50,000
Gold, metal, primary—thousand troy ounces	29,112	30,554	30,880	r 30,535	31,169
Iron and steel:					
Iron ore and concentrate—thousand tons	4,830	5,816	6,797	7,737	8,233
Pig iron—do	2,657	3,271	r 3,422	r 3,429	3,775
Ferroalloys—do	230	332	336	r 360	349
Steel:					
Ingots and castings—do	3,370	r 3,526	r 3,492	3,937	4,019
Semimanufactures •—do	1,923	1,810	1,890	2,310	2,400
Lead, metal content of ore	---	48	---	24	---
Manganese, ore and concentrate, gross weight:					
Metallurgical:					
More than 48 percent Mn	60,722	24,380	29,562	183,008	259,840
45 to 48 percent Mn	333,854	432,860	427,218	290,972	177,190
40 to 45 percent Mn	477,555	580,625	565,287	191,181	180,578
30 to 40 percent Mn	405,983	483,138	602,323	1,089,447	1,268,629
Subtotal	1,278,114	1,521,003	1,624,390	1,754,608	1,881,237
Chemical:					
More than 65 percent MnO_2	8,388	6,764	122	5,706	13,451
Less than 65 percent MnO_2	33,698	39,688	68,445	56,337	77,024
Subtotal	42,086	46,452	68,567	62,043	90,475
Total	1,320,200	1,567,455	1,692,957	1,816,651	1,971,712
Low grade 15 to 30 percent Mn, 20 to 35 percent Fe	147,493	207,981	289,331	284,433	455,480
Nickel, metal, electrolytic •	2,400	3,000	5,400	5,400	5,500
Platinum-group metals:					
Osmiridium from gold ores (sales) troy ounces	4,135	3,820	•3,400	•7,000	•14,000
Content of concentrates, matte, and refinery products • thousand troy ounces	600	750	780	825	850
Silver, metal, primary—do	2,917	3,132	3,134	3,064	3,337
Tantalum, columbium, concentrate	6	3	2	5	18
Tin:					
Concentrate, gross weight—long tons	2,530	2,683	2,827	2,829	2,897
Concentrate, metal content—do	1,586	1,671	1,745	1,761	1,837
Metal, primary—do	1,016	962	822	658	686
Tungsten, concentrate, 60 percent WO_3, gross weight	4	4	8	r 25	48
Uranium, oxide (U_3O_8)[1]	4,032	2,669	2,981	3,048	3,514
Vanadium, oxide (V_2O_5)	2,077	2,461	2,771	3,425	3,126
Nonferrous metals, n.e.s., mainly semimanufactures •	39,000	39,500	43,000	45,400	46,000

See footnotes at end of table.

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Table 2.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS					
Asbestos:					
Amosite	70,103	78,241	87,033	86,090	88,225
Chrysotile	32,587	35,285	33,367	35,649	38,592
Crocidolite	92,891	109,879	130,523	121,824	109,533
Total	195,581	218,405	250,923	243,563	236,350
Barite	2,572	1,340	6,182	1,498	519
Cement thousand tons	3,455	3,882	3,990	4,012	e 4,100
Clays:					
Bentonite	9,313	11,737	11,904	15,162	12,652
Fire clay	266,704	280,288	239,387	r 218,563	179,590
Flint clay	191,965	248,357	182,515	150,985	196,612
Fuller's earth	163	632	----------	1,149	215
Kaolin	39,458	44,344	40,519	32,334	32,711
Corundum, natural	54	313	363	318	256
Diamond, gem and industrial thousand carats	4,450	5,026	r 6,037	6,668	7,433
Diatomite	495	976	218	585	624
Feldspar	36,095	42,304	34,541	24,891	19,888
Fertilizer materials:					
Crude (natural) phosphate rock, beneficiated thousand tons	579	610	1,068	1,552	1,565
Manufactured:					
Phosphatic do	1,331	1,014	1,252	1,099	e 1,100
Mixed do	793	726	707	898	e 900
Fluorspar:					
Acid grade	6,066	4,335	22,984	33,799	40,524
Ceramic grade	2,129	4,829	4,646	4,188	2,896
Metallurgical grade	52,070	56,122	54,258	57,320	65,140
Total	60,265	65,786	81,888	95,307	108,560
Gem stones, semiprecious:					
Emerald kilograms	208	532	4,321	377	928
Tiger's eye [2]	78	78	57	404	148
Graphite, all grades	945	406	1,053	671	728
Gypsum, crude	240,082	303,940	296,539	r 307,592	316,050
Kyanite and related materials:					
Andalusite	13,972	21,919	21,486	24,583	22,444
Sillimanite	54,649	42,148	35,103	35,385	33,195
Lithium minerals	162	869	306	----------	36
Magnesite, crude	84,770	86,898	93,301	80,012	59,797
Mica:					
Sheet kilograms	47,007	907	484	4,232	9,247
Scrap	3,068	2,268	2,234	4,618	7,918
Pigments, natural mineral	4,975	4,741	5,767	8,632	3,894
Pyrite:					
Noncupreous, gross weight	432,475	428,294	481,184	r 552,743	587,564
Cupreous, gross weight	----------	----------	----------	315,919	116,792
Quartz, quartzite, and glass sand [3]	343,999	386,551	422,419	422,502	455,931
Salt thousand tons	300	331	314	317	342
Stone, sand and gravel:					
Dimension stone:					
Calcareous, marble	3,544	4,088	3,938	11,423	18,852
Wonderstone (pyrophyllite)	1,704	3,626	6,271	4,618	5,094
Crushed and broken:					
Lime and limestone thousand tons	8,798	9,793	10,634	11,830	12,891
Shale do	234	247	254	242	246
Talc	6,617	9,241	8,645	9,186	9,052
Vermiculite	101,488	115,131	103,175	101,501	110,180
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	11,945	13,163	NA	NA	NA
Coal:					
Anthracite thousand tons	1,315	1,247	1,077	1,280	1,365
Bituminous do	43,602	47,218	46,865	r 48,021	50,289
Total do	44,917	48,460	47,942	49,301	51,654
Coke:					
Oven and beehive do	2,391	3,194	2,879	e 3,000	e 3,200
Gashouse, low and medium temperature thousand tons	135	162	176	e 175	e 175

See footnotes at end of table.

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Table 2.—Republic of South Africa: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum refinery products:					
Gasoline----thousand 42-gallon barrels--	12,088	11,260	13,491	16,376	NA
Kerosine----do----	1,829	1,753	2,098	2,125	NA
Distillate fuel oil----do----	8,880	8,869	10,000	13,586	NA
Residual fuel oil----do----	10,715	8,226	10,550	14,677	NA
Other----do----	1,406	1,098	1,480	2,478	NA
Total----do----	34,868	31,201	37,619	49,237	NA

• Estimate. ᵣ Revised. NA Not available.
[1] Includes stockpile.
[2] Decorative material resulting from oxidation and silicification of crocidolite.
[3] Includes silcrete, a rock containing up to 98 percent silica.

TRADE

Official trade statistics for the Republic of South Africa include imports and exports for Botswana, Lesotho, Swaziland, and the Territory of South-West Africa but not interterritorial shipments among these political divisions. Although certain mineral commodities, particularly some metallic ores and nonmetallic minerals, are believed to have originated in these countries, the great bulk of trade involves South Africa itself.

The following tabulation indicates the significance of the continuing favorable trade balance in mineral commodities in contrast to the increasing overall trade deficit:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1966	ᵣ 778	ᵣ 1,690
1967	855	1,911
Imports:		
1966	ᵣ 869	2,304
1967	426	2,687
Trade balance:		
1966	+404	−614
1967	+429	−776

ᵣ Revised.
[1] Includes only those commodities listed in tables 3 and 4 of this chapter. Does not include transactions in monetary gold.

In 1968 the Republic continued as a major world source of a number of ores and crude nonmetals. Export value of major mining products, exclusive of gold, were as follows:

	Value (thousands)
Antimony concentrate	$8,186
Asbestos	40,218
Chromite	9,790
Clays	3,453
Coal	9,354
Copper (metallic)	116,592
Diamond (sales)	105,805
Fluorspar	2,392
Iron ore	24,237
Manganese ore	27,540
Sillimanite and andalusite	2,352
Granite	4,160
Tin concentrate	3,348
Vanadium pentoxide	6,887
Vermiculite	2,295

Major mineral commodity exports to the United States, in order of value, were diamond, unwrought copper, metalliferous ores, iron and steel, and asbestos.

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Table 3.—Republic of South Africa: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Oxide and hydroxide	2	17	NA.
Metal, including alloys:			
Scrap	992	1,405	West Germany 600; Japan 207.
Unwrought and semimanufactures	1,620	1,419	NA.
Antimony, ore and concentrate	17,679	20,585	United Kingdom 13,383; United States 5,207.
Arsenic, oxides and acids	137	899	United States 898.
Chromium:			
Chromite	r 856,815	656,900	United States 282,727; Japan 111,593; West Germany 91,853.
Oxide and hydroxide	134	213	NA.
Copper:			
Ore and concentrate	20,442	7,737	Japan 7,486.
Matte	86	41	NA.
Metal, including alloys:			
Scrap	36	411	West Germany 157; Spain 126.
Unwrought:			
Blister and other unrefined [3]	71,636	68,627	United States 39,836; Japan 11,319.
Refined [2]	50,111	79,036	West Germany 33,167; Japan 25,613.
Semimanufactures	3,413	5,427	West Germany 2,772; Netherlands 519.
Gold, metal, unworked or partly worked. troy ounces	6,384	13,839	NA.
Iron and steel:			
Ore and concentrate [2] thousand tons	3,089	4,269	Japan 4,212.
Roasted pyrite	-------	2,172	NA.
Metal:			
Scrap	r 1,493	5,906	Japan 4,876.
Pig iron	r 769,930	933,546	Japan 761,380; West Germany 110,377.
Powder and shot	126	217	Bolivia 92.
Spiegeleisen	13,398	2,106	Italy 1,918.
Ferroalloys:			
Ferromanganese	r 156,881	127,834	United Kingdom 37,312; United States 34,962; Australia 13,866.
Ferrochrome	r 79,862	90,340	United States 25,459; West Germany 18,115; Canada 16,894.
Ferrosilicon	25,726	26,979	Japan 8,613; Australia 5,227; United Kingdom 2,915.
Other	6,732	2,361	Japan 1,016; United Kingdom 610.
Ingots and other primary forms	r 3,907	805	NA.
Semimanufactures:			
Bars and rods	r 47,692	24,921	United States 6,207.
Angles, shapes and sections	r 16,412	24,066	NA.
Plate and sheet	r 79,166	118,780	Italy 31,743.
Hoop and strip	2,833	3,439	NA.
Rails and accessories	14,169	24,660	NA.
Wire	4,270	6,709	NA.
Tubes, pipes, and fittings	21,066	24,952	NA.
Castings and forgings	1,226	810	United Kingdom 416.
Total	r 186,836	228,337	
Lead: [2]			
Ore and concentrate	75,924	-------	
Concentrate, with vanadium	14,889	4,429	All to West Germany.
Oxide	88	93	NA.
Metal, including alloys:			
Unwrought	59,854	65,589	Italy 17,107; United Kingdom 13,706; Japan 8,412.
Semimanufactures	27	51	NA.
Magnesium, metal, including alloys:			
Scrap	13	57	United States 34.
Unwrought and semimanufactures	-------	1	NA.
Manganese:			
Ore and concentrate thousand tons	1,354	1,354	France 213; United States 208; Netherlands 193; Japan 178; United Kingdom 171.
Oxide	3	10	NA.
Metal, electrolytic	5,977	7,994	United States 1,789; United Kingdom 1,730; Sweden 1,004; Canada 954.
Mercury 76-pound flasks	6	15	NA.
Nickel:			
Ore and concentrate	-------	5	NA.
Matte, speiss, and similar materials	12	78	NA.
Metal, including alloys:			
Scrap	61	63	NA.
Unwrought	1,286	3,573	West Germany 2,709, Italy 499.
Semimanufactures	71	107	Italy 81.

See footnotes at end of table.

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Table 3.—Republic of South Africa: Exports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Platinum-group, metals, including alloys, all forms. troy ounces	128	1	NA.
Silver:			
Ore and concentrate—value, thousands	$9,844	$3,072	United States $2,762.
Waste and sweepings troy ounces	14,108	463	NA.
Metal, including alloys. thousand troy ounces	11,828	11,176	United States 9,747; United Kingdom 1,331.
Tin:			
Ore and concentrate long tons	2,641	2,498	United Kingdom 1,263; Netherlands 1,218.
Metal:			
Scrap do	27	156	West Germany 120.
Unwrought and semimanufactures. do	121	57	NA.
Titanium, oxide	47	59	NA.
Tungsten:			
Ore and concentrate	12	57	United Kingdom 29; Japan 10; West Germany 10.
Metal, including alloys, all forms	17	10	Ireland 4.
Vanadium, pentoxide, fused	2,759	2,750	Austria 900; United Kingdom 804; Japan 391.
Zinc: [2]			
Ore and concentrate	45,598	39,453	United States 15,035; West Germany 12,711; United Kingdom 10,224.
Oxide	86	159	NA.
Metal, including alloys:			
Scrap, dust and powder	518	72	NA.
Unwrought and semimanufactures	86	73	NA.
Other:			
Ore and concentrate:			
Molybdenum, tantalum, titanium, vanadium, and zirconium.	14	137	West Germany 102; United States 31.
Base metals, n.e.s	1,659	3,840	United Kingdom 2,240; Japan 704; West Germany 689.
Ash and residue containing nonferrous metals.	3,895	819	NA.
Metals, including alloys, all forms:			
Metalloids	9	-------	
Alkali, alkali earth, and rare-earth metals.	-------	32	NA.
Base metals, n.e.s	152	259	United Kingdom 189.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	94	5	NA.
Grinding and polishing wheels and stones	174	181	NA.
Asbestos	r 233,518	234,020	United Kingdom 59,343; Japan 29,441; United States 26,558.
Barite	3,282	63	NA.
Boron materials, boric oxide and acid	4	9	NA.
Cement	r 92,186	78,043	NA.
Chalk	6	12	NA.
Clays and clay products:			
Crude clays, n.e.s	113,696	138,692	Japan 49,706; West Germany 35,963; United Kingdom 24,886.
Kyanite and sillimanite	42,960	45,042	Japan 23,091; United Kingdom 11,037.
Products:			
Refractory	20,668	20,236	NA.
Nonrefractory	5,325	5,939	NA.
Diamond:			
Gem:			
Unworked thousand carats	2,630	2,777	United Kingdom 2,666.
Not set or strung carats	175	185	Belgium 86; Hong Kong 40.
Industrial:			
Natural thousand carats	19,996	19,799	Ireland 14,420; United Kingdom 5,242.
Manufactured do	2,488	1,972	Ireland 1,825.
Diatomite	248	421	NA.
Feldspar	8,263	7,163	West Germany 4,390; Italy 1,680.
Fertilizer materials:			
Crude, phosphate rock	465	973	NA.
Manufactured:			
Nitrogenous	r 2,447	56,600	NA.
Phosphatic	2,150	2,192	NA.
Potassic	15	436	NA.
Other, including mixed	r 3,454	19,263	NA.
Ammonia	372	614	NA.

See footnotes at end of table.

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Table 3.—Republic of South Africa: Exports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Fluorspar	85,493	90,064	Japan 55,605; United States 11,613.
Graphite, natural	42	54	NA.
Gypsum and plasters	8,014	9,616	NA.
Lime	14,673	4,692	NA.
Magnesite	3,899	6,378	NA.
Mica:			
Crude, including splittings and waste	3,033	7,028	United Kingdom 5,002; West Germany 532.
Worked, including agglomerated splittings. value, thousands	$3	-------	
Pigments, mineral:			
Natural, crude	r 1,943	2,062	United Kingdom 1,673.
Iron oxides, processed	177	216	NA.
Precious and semiprecious stones, except diamond:			
Precious thousand carats	1,719	1,635	Switzerland 1,585.
Semiprecious kilograms	227,875	408,296	United States 158,615; Japan 76,629; West Germany 50,270; United Kingdom 47,073.
Salt	r 31,632	30,519	NA.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	67	41	NA.
Caustic potash	8	-------	
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	4,502	893	United States 724.
Granite	r 115,153	144,290	France 88,346; West Germany 25,365; Netherlands 19,565.
Slate	185	64	NA.
Worked:			
Slate	-------	49	NA.
Other	61	54	NA.
Dolomite, chiefly refractory grade	9,842	11,879	NA.
Gravel and crushed rock	1,051	1,004	United Kingdom 582.
Limestone, except dimension	3,104	3,705	NA.
Quartz and quartzite	544	817	West Germany 161.
Sand, excluding metal bearing	3,220	3,404	NA.
Sulfur:			
Elemental:			
Other than colloidal	86	5,060	NA.
Colloidal	42	18	NA.
Sulfur dioxide	-------	1	NA.
Sulfuric acid	308	615	NA.
Talc and steatite	181	376	NA.
Vermiculite	r 77,921	95,819	United Kingdom 27,410; Italy 17,817; United States 14,482.
Other nonmetals, n.e.s.:			
Crude	1,582	1,405	Japan 670.
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	-------	4,299	NA.
Slag and ash, n.e.s	-------	280	NA.
Oxides and hydroxides of magnesium, strontium, and barium.	18	11	NA.
Building materials of asphalt, asbestos, and fiber cement and unfired nonmetals, n.e.s.	5,435	9,842	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	10	23	NA.
Carbon black and gas carbon	1,125	1,333	NA.
Coal and briquets:			
Anthracite	503,010	650,098	Japan 326,643; Italy 226,965.
Other	610,234	606,443	NA.
Coke and semicoke	1,230	1,326	NA.
Gas, hydrocarbon:			
Natural	1,482	2,369	NA.
Manufactured	222	532	NA.
Petroleum:			
Refinery products:			
Gasoline thousand 42-gallon barrels	r 470	638	NA.
Kerosine and jet fuel do	597	594	Ships' stores 306.

See footnotes at end of table.

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Table 3.—Republic of South Africa: Exports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum—Continued			
Refinery products—Continued			
Distillate fuel oil.—thousand 42-gallon barrels	1,578	2,566	Ships' stores 1,391.
Residual fuel oil—do	8,319	15,917	Ships' stores 13,996.
Lubricants—do	r 320	283	Ships' stores 39.
Mineral jelly and wax—do	81	85	United States 34; West Germany 19.
Other:			
Nonlubricating oils—do	r 2	r 4	NA.
Pitch and pitch coke	196	54	NA.
Bitumen and other residues	8,772	7,152	NA.
Bituminous mixtures, n.e.s	8,427	10,517	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals:			
Mineral tar	183	2,243	NA.
Other—thousand 42-gallon barrels	1	1	NA.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics, Volume I, 1967, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.
[2] Partially or wholly from Botswana, Lesotho, Swaziland, or Territory of South-West Africa.

Table 4.—Republic of South Africa: Imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	15,685	8,443	NA.
Oxide and hydroxide	568	696	West Germany 433; United Kingdom 134.
Metal, including alloys:			
Scrap	87	137	NA.
Unwrought	27,388	17,689	Canada 15,473.
Semimanufactures	9,878	10,083	Canada 4,050; United Kingdom 2,809.
Arsenic, trioxide, pentoxide, and acids	245	522	France 511.
Chromium:			
Chromite	r 98,269	29,874	NA.
Oxide and hydroxide	47	70	NA.
Cobalt, oxide and hydroxide	14	8	All from Canada.
Copper:			
Ore and concentrate	6,242	8,412	NA.
Metal, including alloys:			
Scrap	188	76	NA.
Unwrought, mainly refined	89,118	82,752	NA.
Semimanufactures	4,037	4,258	United Kingdom 1,801; Belgium 807.
Gold, metal, unworked or partly worked.—troy ounces	12,660	22,675	NA.
Iron and steel:			
Ore and concentrate	30	14	NA.
Roasted pyrite	1	1	NA.
Metal:			
Scrap	r 13,542	9,519	NA.
Pig iron, ferroalloys, and similar materials.	5,155	93,594	NA.
Steel, primary forms, mainly blooms, billets, and slabs.	20,074	39,053	NA.
Semimanufactures:			
Bars and rods	10,846	10,753	United Kingdom 5,515; West Germany 1,469; Sweden 1,123.
Angles, shapes, and sections	9,644	10,686	United Kingdom 6,022; Belgium 3,270.
Plate and sheet	r 129,899	264,669	United Kingdom 157,060; Netherlands 38,674; Japan 31,722.
Hoop and strip	3,572	3,979	Sweden 882; United Kingdom 759; West Germany 663.
Rails and accessories	6,316	7,777	NA.
Wire	8,972	16,782	Belgium 7,532; Netherlands 3,992; United Kingdom 2,488.

See footnotes at end of table.

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Table 4.—Republic of South Africa: Imports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Semimanufactures—Continued			
Tubes, pipes, and fittings	23,546	24,115	United Kingdom 7,756; Japan 5,063; West Germany 4,878.
Castings and forgings, rough	7,670	4,209	United Kingdom 1,832; Australia 990.
Total	r 200,465	342,920	
Lead:			
Oxides	48	85	NA.
Metal, including alloys:			
Scrap	1,455	3,189	Canada 304; New Zealand 208.
Unwrought	4,705	5,499	NA.
Semimanufactures	2,652	1,309	NA.
Magnesium, metal, including alloys, all forms	112	353	Norway 256; United States 64.
Manganese:			
Ore and concentrate	945	426	NA.
Oxides	1,452	1,119	United Kingdom 779.
Mercury—76-pound flasks	3,356	1,125	Spain 291; Mexico 276; Italy 193.
Molybdenum, metal, including alloys, all forms.	10	5	United States 3; United Kingdom 2.
Nickel, metal, including alloys, all forms	r 543	426	United Kingdom 255.
Platinum-group metals, troy ounces, including alloys, all forms.	3,678	3,715	United Kingdom 3,283.
Silver:			
Waste and sweepings—do	-------	1,543	NA.
Metal, including alloys—do	142,970	165,463	United States 47,826; West Germany 40,323; United Kingdom 26,225.
Tin:			
Ore and concentrate—long tons	-------	1	NA.
Oxide—do	28	13	United Kingdom 7.
Metal:			
Scrap—do	24	5	NA.
Unwrought and semi-manufactures—do	r 448	547	West Germany 127; United Kingdom 92.
Titanium, oxide	155	162	United States 62; United Kingdom 52.
Tungsten:			
Ore and concentrate	433	795	Australia 243; United States 216.
Metal, including alloys, all forms	26	42	United Kingdom 17.
Uranium and thorium, oxides, including rare-earth oxides, kilograms	1,874	3,380	NA.
Zinc:			
Ore and concentrate	1	5	NA.
Oxide	153	188	West Germany 49; United States 44.
Metal, including alloys:			
Scrap, including powder and dust	r 450	1,094	United States 233.
Unwrought	39,022	49,098	NA.
Semimanufactures	388	996	NA.
Other:			
Ore and concentrate:			
Titanium-vanadium	12,563	11,896	Australia 11,814.
Base metals, n.e.s	1,326	2,511	Australia 2,221.
Ash and residue containing nonferrous metals.	288	912	United Kingdom 199.
Metals, including alloys, all forms:			
Metalloids	1,290	905	Sweden 373; Belgium 250.
Alkali, alkali earth, and rare-earth metals.	197	13	Austria 5.
Base metals, n.e.s	301	380	United Kingdom 49; France 19; Belgium 11.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc	4,898	2,837	NA.
Grinding and polishing wheels and stones.	179	228	NA.
Asbestos	11,306	13,994	NA.
Barite	3,053	2,564	West Germany 865; Italy 415.
Boron materials:			
Crude natural borates	815	347	United States 335.
Oxide and acid	410	698	United States 420; France 227.
Cement	r 114,062	35,524	United Kingdom 6,106; Japan 3,333.
Chalk	3,885	3,535	France 2,259; United Kingdom 767.

See footnotes at end of table.

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Table 4.—Republic of South Africa: Imports of mineral commodities[1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Clay and clay products:			
Crude clays and refractory minerals	14,209	9,080	United States 4,671; United Kingdom 2,952.
Products:			
Refractory	10,723	15,548	Austria 4,773; West Germany 3,041; United Kingdom 2,592.
Nonrefractory	9,213	6,427	NA.
Cryolite and chiolite	46	112	NA.
Diamond:			
Gem:			
Unworked—carats	27,351	1,414	Netherlands 348.
Not set or strung—do	1,477	1,868	Belgium 900; Israel 820.
Industrial—thousand carats	13,259	19,139	United Kingdom 5,231; Ireland 2,706.
Diatomite	3,280	3,587	United States 3,027; West Germany 514.
Feldspar	144	203	NA.
Fertilizer materials:			
Crude:			
Nitrogenous	1,060	960	West Germany 909.
Phosphatic	r 175,869	87,570	NA.
Potassic	64,916	116,707	France 35,559; West Germany 30,033; United States 19,335.
Manufactured:			
Nitrogenous	r 81,292	75,969	Netherlands 27,029; Portugal 19,844; Japan 12,200.
Phosphatic:			
Thomas (basic) slag	20,956	17,835	All from Belgium.
Other	50,369	79,101	NA.
Potassic	66,630	53,200	West Germany 14,711; France 14,633; Canada 11,068.
Other, including mixed	13	35	NA.
Ammonia	1	1	NA.
Graphite, natural	428	472	United States 217; Norway 134.
Gypsum and plaster	4,674	4,777	West Germany 3,547; United Kingdom 1,200.
Lime	61	262	NA.
Magnesite	r 80,598	55,133	Italy 4,010; United Kingdom 3,072; Japan 2,347.
Mica:			
Crude, including splittings and waste	380	191	NA.
Worked, including agglomerated splittings—value, thousands	$608	$641	United Kingdom $488.
Pigments, mineral:			
Natural, crude	469	661	Austria 187; United Kingdom 158.
Iron oxides, processed	1,994	2,172	West Germany 1,528; United Kingdom 552.
Precious and semiprecious gem stones, except diamond:			
Natural—value, thousands	$446	$516	United Kingdom $70; West Germany $59.
Manufactured—do	$57	$1,805	NA.
Pyrite	7,608	7,797	Spain 7,762.
Salt (excluding brines)	r 1,760	2,138	United Kingdom 2,072.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	10,467	14,749	Netherlands 7,249; West Germany 2,673.
Caustic potash	602	514	France 173; Belgium 143.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	1,287	1,148	Italy 937.
Other	16	66	NA.
Worked	183	254	Italy 196.
Gravel and crushed rock	958	4,511	NA.
Limestone (except dimension)	57	97	NA.
Quartz and quartzite	117	20	NA.
Sand, excluding metal bearing	280	306	NA.
Sulfur:			
Elemental:			
Other than colloidal	r 184,573	200,130	United States 87,570; Canada 62,377.
Colloidal	188	299	United States 143; West Germany 142.
Sulfur dioxide	36	30	NA.
Sulfuric acid	8	2,271	NA.
Talc and steatite	1,218	1,689	Italy 617; Norway 402.
Other nonmetals, n.e.s.:			
Crude	436	687	United Kingdom 134; United States 85.

See footnotes at end of table.

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Table 4.—Republic of South Africa: Imports of mineral commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Other nonmetals, n.e.s.—Continued			
Slag, dross, and similar waste, not metal bearing:			
From iron and steel manufacture	-------	21,118	All from Canada.
Slag and ash, n.e.s	10,542	22	NA.
Oxides and hydroxides of magnesium, strontium, and barium.	62	110	United Kingdom 45; United States 32.
Building materials of asphalt, asbestos and fiber cement, and unfired nonmetals, n.e.s.	1,547	1,711	Austria 510; United States 369.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	14,735	8,336	United States 4,768.
Carbon and carbon black	4,095	5,064	United States 3,742; United Kingdom 803.
Coal, all grades, including briquets	655	753	NA.
Coke and semicoke	25,892	3,810	NA.
Gas, hydrocarbon:			
Natural	30	112	United States 84.
Manufactured	9	13	NA.
Hydrogen, helium, and rare gases	3	9	Canada 3.
Peat	39	30	NA.
Petroleum:			
Crude—thousand 42-gallon barrels	35,119	67,073	NA.
Partly refined—do	5,072	6,262	NA.
Refinery products:			
Gasoline—do	r 7,038	3,412	NA.
Kerosine and jet fuel—do	3,318	3,371	NA.
Distillate fuel oil—do	4,452	3,196	NA.
Residual fuel oil—do	180	4,243	NA.
Lubricants—do	1,365	1,472	United States 492; United Kingdom 258; Australia 190.
Mineral jelly and wax—do	171	216	United States 149; West Germany 19.
Other:			
Nonlubricating oils, n.e.s.—do	294	420	United States 169; United Kingdom 86.
Pitch	r 923	994	NA.
Pitch coke	r 53	51	NA.
Petroleum coke	14,380	11,392	NA.
Bitumen and other residues	5,879	5,347	United States 2,325; Netherlands 1,760.
Bituminous mixtures, n.e.s	513	531	United States 122.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals:			
Mineral tar	25	34	NA.
Other—thousand 42-gallon barrels	197	22	United Kingdom 12; Netherlands 9.

r Revised. NA Not available.

[1] Source: Foreign Trade Statistics, Volume I, 1967, compiled by the Department of Customs and Excise, and includes Botswana, Lesotho, Swaziland, and the Territory of South-West Africa.

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Table 5.—Republic of South Africa: Principal mineral commodity trade

(Thousands)

Commodity	1966	1967
EXPORTS		
Asbestos	$41,598	$42,040
Copper	125,688	164,521
Diamond:		
Gem	221,148	217,928
Industrial	66,830	70,225
Iron and steel	100,012	108,051
Metallic ores, concentrates, and scrap	99,877	93,582
Petroleum refinery products	45,665	75,959
Other	72,620	82,955
Total	778,488	855,261
IMPORTS		
Aluminum	21,057	17,259
Copper	42,502	40,328
Fertilizers	8,253	6,811
Iron and steel	56,666	91,687
Petroleum:		
Crude and partly refined	67,796	121,918
Refinery products	76,647	85,084
Sulfur	6,429	7,991
Zinc	11,634	13,846
Other	78,252	91,228
Total	369,236	426,092

Source: Republic of South Africa, Department of Customs and Excise, Foreign Trade Statistics, v. I, 1967.

Table 6.—Republic of South Africa: Major mineral sales

(For domestic use and for export)

Commodity	Thousands	
	1967	1968
METALS		
Antimony concentrate	$6,544	$8,215
Chromite	10,754	12,025
Copper concentrate and metal	139,128	140,930
Gold	1,075,337	1,097,164
Iron ore	37,701	41,099
Manganese ore	33,689	33,517
Silver	4,951	7,335
Tin concentrate and metal	5,490	5,710
Vanadium pentoxide and ammonium vanadate	7,775	8,249
NONMETALS		
Andalusite and sillimanite	3,003	2,524
Asbestos	37,342	43,352
Clays	4,957	5,531
Diamond (sales)	83,025	105,805
Fluorspar	2,407	2,732
Granite and granitic rocks	11,363	13,506
Limestone and dolomite	17,881	19,030
Phosphate, crude and processed	12,360	14,016
Pyrite, cupreous and noncupreous	7,147	6,962
Salt	3,813	3,975
Sandstone	2,465	2,580
Silica	1,704	1,999
Vermiculite	2,177	2,400
MINERAL FUELS AND RELATED MATERIALS		
Coal, anthracite and bituminous	121,647	135,720
Miscellaneous minerals	169,363	197,742
Total	1,802,023	1,912,118

Source: Republic of South Africa, Department of Mines, Mining Statistics, 1968.

COMMODITY REVIEW

METALS

Aluminum.—A project study for the Republic's first primary aluminum reduction plant, at Richards Bay, Natal coast, was completed in conjunction with representatives of Alusuisse, the national aluminum company of Switzerland, which will be technical advisor for the project. Late in the year the Government-owned Industrial Development Corp. (IDC) was authorized to proceed with the project, and a 290-acre site was purchased. The South African Railways Administration started rail construction between the plant site and port.[5] The production company will be known as Alusaf (Pty.) Ltd.

Estimated total cost for the 50,000-ton-per-year plant is $67 million, $1 million of which was to be spent during 1968 and early 1969, and the remainder appropriated over the next 3 years. A total of $29 million was planned in share capital, and the remaining $38 million would be provided by loan agreements. The Government planned a one-third overseas interest. Alcan Aluminium of South Africa Ltd. and Republic Aluminium of South Africa Ltd. will participate as investors. Plant construction was scheduled for completion in mid-1971. Specifications for later expansion to annual capacity of 200,000 tons were included in the project.

In November Alcan completed a $6 million hot rolling mill for 84-inch sheet at its Pietermaritzburg plant. The plant, reputed to be the largest aluminum rolling mill in Africa, is part of Alcan's $22 million, 10-year development program. Alcan plans to market about 20,000 tons of semifabricated aluminum products in 1969

[5] Industrial Development Corp. Annual Report and Accounts. No. 28, financial year ended June 30, 1968, p. 16.

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and, at a later date, provide for all domestic demand for these products. Aluminum ingot will be imported from the parent company in Canada pending completion of the Richards Bay project.

Antimony.—Consolidated Murchison (Transvaal) Goldfields and Development Co. Ltd., the only producer of antimony in the Republic, continued as an important supplier of antimony to the United Kingdom and the United States. Demand remained firm, and a high level of sales was achieved. Extensions to the reduction plant were completed, and the plant was operated at peak annual capacity of 20,000 tons. In December a decision was made to increase beneficiation capacity by about 1,800 tons per year and incorporate a drying unit in the reduction circuit at an estimated cost of $500,000. Mining operations in the Letaba district, Transvaal, were as follows:

	1967	1968
Ore milled—metric tons	187,200	226,500
Production of antimony:		
Concentrate and cobbed ore—metric tons	20,159	27,372
Average grade—percent	61.19	61.43
Recovery, metal—do	92.11	93.62
Production of gold troy ounces	2,069	3,823
Ore reserves—metric tons	531,000	547,000

Copper.—*Palabora Mining Co. Ltd.*—Major production statistics for Palabora operations at the Phalaborwa mine, the largest copper mine in the Republic, were as follows:

	1967	1968
Ore milled thousand metric tons	13,272	14,314
Average grade—percent	0.71	0.64
Production of blister (anode) copper—metric tons	76,538	72,060
Production of refined (cathode) copper—metric tons	-------	39,441
Gross sales (including vermiculite, sulfuric acid, and magnetite)—thousands	$89,496	$94,605
Average selling price, per ton of ore mined	$6.12	$6.00
Average cost, per ton of ore mined	$2.60	$3.07
Average cost per pound of copper produced	$0.23	$0.21

In addition, the company produced 22,732 tons of wire bars and 2,400 tons of rods in 1968. According to the company's annual report, ore reserves at yearend were 285 million tons at 0.69 percent copper.

South Africa's first electrolytic copper refinery, which started production in October 1967, reached its rated annual capacity of 40,000 tons in April 1968 [6] and supplied the country's total requirements of refined copper. A planned $6 million, 2-year expansion program will add a new section to the concentrating plant and permit treatment of stockpiled low-grade ore.[7]

Late in the year, American Metal Climax Inc. sold its 9.3 percent share in Palabora Mining Co. Ltd. to the IDC, the South African Government agency, for $19.5 million.[8] The shares reportedly were spread among South African financial houses.

O'okiep Copper Co. Ltd.—According to the company's annual report for 1968, operating data for eight active mines and three mills was as follows:

	1967	1968
Ore milled thousand metric tons	2,874	2,912
Average grade of ore—percent	1.51	1.44
Production of blister copper metric tons	38,582	37,595
Sales of blister copper—do	39,376	42,786
Total metal sales—thousands	$43,074	$50,314

During 1968, $1.3 million was spent on geologic and geophysical studies and on diamond drilling. Ore reserves were increased by 2 million tons with extensions to known ore bodies. At yearend ore reserves totaled 24.9 million tons at 1.62 percent copper.

Messina (Transvaal) Development Co. Ltd.—Operational data at the Messina mine and smelter for the financial years ending September 30 were as follows:

	1967	1968
Production of ore thousand metric tons	1,022	988
Average grade of ore—percent	1.19	1.18
Ore milled thousand metric tons	954	951
Concentrate smelted metric tons	36,340	35,910
Average grade of concentrate percent	33.97	35.22
Production of refined copper metric tons	11,753	12,302
Cost per ton of ore milled	$5.11	$5.77

[6] South African Mining and Engineering Journal. V. 79, No. 3940, Aug. 9, 1968, p. 323.
[7] Metal Bulletin. No. 5327, Aug. 27, 1968, p. 18.
[8] Engineering and Mining Journal. V. 169, No. 12, December 1968, p. 138.

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The new four-compartment Spence shaft to new ore bodies at depths of 270 to 340 meters was at 90 meters below collar at yearend. Underground development totaled 17,553 meters for the year. Proved ore reserves were 6.2 million tons averaging 1.40 percent copper.

Other.—Rustenburg Platinum Mines Ltd., primarily a producer of platinum-group metals, does not disclose production data, but output of byproduct copper matte probably totaled 3,200 tons in 1968.

Gold.—Production reached another record level as all main mining areas except Klerksdorp and the Orange Free State groups reported increased output. The Orange Free State remained the leading producing area, although output fell from 12.7 million ounces in 1967 to 11.1 million ounces in 1968. Production from other major areas was as follows: Far West Rand, nearly 8 million ounces; Klerksdorp, 4.9 million ounces; East Rand, 4.7 million ounces; and Evander, 2.0 million ounces. Working costs continued to rise, reaching an average of $8.81 per ton of ore milled, compared with $8.61 per ton in 1967. Based on an unchanged gold price, it was estimated that the ultimate peak production would be attained during the next few years, following which production would gradually decrease. There was one mine closure (Daggafontein) in 1968, and three (New Kleinfontein, Randfontein, and Van Dyk Consolidated) were on cleanup operations. Three new mines (Kinross, Kloof, and Elsburg) opened during the year, and others were in planning or under development.

South Africa's gold-mining industry faced its greatest threat on October 26, 1968, when the West Driefontein mine, the largest producing mine and one of the richest in the country, was partially flooded from fissured ground adjacent to the mine. Output from this mine, owned by Gold Fields of South Africa Ltd., represents 8 percent of the Republic's annual total and approximately 5 percent of Free World output. The groundwater inflow rate reached 100 million gallons per day on November 3, about 40 million gallons in excess of pump capacity, and 2 days later all underground work was temporarily suspended. On November 12, grouting was completed on four 18-meter plugs on the 10 and 12 levels. High pressure valves were closed on November 18, and appeared to hold. On November 29 mining was started on the upper, unaffected levels. At yearend 25 percent of the mine was working, and company officials predicted complete recovery by July 1969.

The flooding also threatened development work at the adjoining East Driefontein mine, jointly owned by Gold Fields of South Africa Ltd. and the Anglo American Corporation of South Africa Ltd. and the potentially richest gold mine to be developed in the last decade. East Driefontein Gold Mining Co. Ltd., the operating company, was incorporated in South Africa in May. Thirty million shares at 1 Rand ($1.40) were offered. Estimated total cost was $98 million for a 140,000-ton-per-month operation, including $42.7 million for shaft sinking to 3,600 meters and $14.5 million for a 45,000-ton-per-month reduction plant.[9] Plans include later expansion to a monthly mining rate of 180,000 tons and monthly reduction capacity of 90,000 tons. Shaft Sinkers Ltd., South Africa, was awarded a $9 million contract for work on the Nos. 1 and 2 shafts (1,500 and 1,250 meters, respectively). Sinking was underway at yearend. Ore reserves are 77 million metric tons averaging 0.525 troy ounce per ton.

The new Kloof mine of Kloof Mining Co. Ltd. in the Far West Rand group was officially opened on January 29 at a cost of $63 million. The planned initial milling rate is 90,000 tons per month. Reserves at time of lease were estimated at 90 million tons at 0.40 ounce per ton at a 50-inch stoping thickness.

Anglo American Corporation of South Africa Ltd. which operated 14 mines reported output of 12,537,000 ounces in financial year 1968 (ending September 30), 3.5 percent more than the previous year. This was 40 percent of total South African output and nearly 31 percent of free world output. Expansion of hoisting capacity continued at Vaal Reefs North Mine, and shaft sinking was underway at Vaal Reef South.

Union Corp. Ltd., which administers eight gold mines, produced 3,600,985 ounces in 1968, down from the 4,089,851 ounces in 1967, owing to lower production at East Geduld and Grootulei. A new shaft (No. 8) was commissioned at St. Helena, and the No. 5 shaft at Winkelhaak was sunk to 1,700 meters during the year.

[9] Rand Daily Mail. May 27, 1968, pp. 16–17.

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Iron, Steel, and Ferroalloys.—Output of iron ore, pig iron, and steel ingots and semimanufactures showed modest increases during 1968 as expansion continued in several sectors of the industry. Demand for steel was curtailed by government policies to contain inflation and by postponement of a number of large government capital expenditures. Substantial excess capacity resulted, and steel orders were weakened. However, the long-term outlook remained favorable. According to the economic development program of the Department of Planning, annual demand was expected to exceed 4 million tons by 1971 compared with annual demand of 3 million tons in 1967.

Table 7.—Republic of South Africa: Gold output, by major producers, 1968

(Troy ounces)

Company or mine	Production
Blyvooruitzicht	1,023,576
Bracken	481,947
Buffelsfontein	1,274,288
City Deep	171,476
Crown Mines	171,008
Doornfontein	770,500
Durban Deep	450,545
East Daggafontein	303,754
East Geduld	201,309
East Rand	708,073
Freddies Consolidated	436,162
Free State Geduld	2,006,716
Free State Saaiplaas	671,025
Grootvlei	461,367
Harmony	914,121
Hartebeestfontein	787,759
Kinross	487,095
Kloof	367,284
Leslie	521,297
Libanon	569,006
Loraine	446,858
Luipaards Vlei	129,388
Marievale	297,566
President Brand	1,638,351
President Steyn	922,890
Rand Leases	105,184
St. Helena	1,102,149
South Africa Lands	353,526
Stilfontein	686,932
Sub Nigel	166,928
Vaal Reefs	1,108,945
Venderspost	550,582
Virginia	450,779
Vlakfontein	300,206
Vogelstruisbult	172,079
Welkom	775,257
West Driefontein	2,487,815
Western Areas	707,068
Western Deep Levels	1,875,436
Western Holdings	1,757,628
Western Reefs	672,816
West Rand Consolidated	268,958
Winkelhaak	537,128
Zand Pan	333,988
Miscellaneous	542,176
Total	31,168,831

Source: Chamber of Mines of South Africa.

South African Iron and Steel Industrial Corp. Ltd. (ISCOR).—This Government-controlled and Government-operated company accounted for about 80 percent of steel output in 1968. According to the company's annual report for the fiscal year ended June 30, output at the Pretoria and Vanderbijlpark plants was 2,761,867 tons of pig iron and 3,194,558 tons of ingots. The company sold 2.25 million tons of steel products valued at $270 million. A $780 million expansion program, partially suspended in 1967, was revitalized in 1968. Major goals are annual ingot capacity of 4.7 million tons by 1970 and 8 million tons by 1980. At Pretoria, expansion of ingot capacity to 1.5 million tons was near completion. At Vanderbijlpark, where most of the expanded capacity was centered, extensions included two 210-ton-per-day oxygen plants, four soaking pits with total capacity of 600 tons per day, and a number of production units in the cold rolling mill area. A $13 million electrolytic galvanizing line was under construction, and a fourth blast furnace was planned. At yearend, proposals for a third steelworks were submitted to the Ministry of Economic Affairs.

ISCOR's Thabazimbi mine produced 2 million tons of iron ore in 1968, and the Sishen mine produced 2.5 million tons. Expansion at Sishen totaled $5.3 million, largely on improved rail facilities. Plans to double the Sishen mine capacity to about 5 million tons were approved. Secondary crushing and fine ore beneficiation plants were completed at Thabazimbi. Development of the large Kraaipan deposit, northeast of Sishen, for the export market remained in the planning stage. ISCOR offered Japanese steelmakers 5 million tons of Kraaipan ore, upgraded to 65 percent iron and possibly pipelined in slurry form to Richards Bay, where port development for larger ore carriers was underway.[10] Lump ore from the Sishen mine also was offered. Iron ore sales to Japan exceeded 2 million tons yearly during 1965–67 and were valued at $21 million in 1967.[11] Because of high rail and port charges established by the South African Railways and Harbour Administration, the Japanese decided to restrict purchases to "spot" orders. In Tokyo during October, ISCOR

[10] Mining Journal (London). V. 271, No. 6942, Sept. 6, 1968, p. 173.
[11] Mining Journal (London). V. 271, No. 6945, Sept. 27, 1968, p. 226.

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Table 8.—Republic of South Africa: Salient statistics of gold and uranium production by members of the Transvaal and Orange Free State Chamber of Mines

		1967	1968
Number of operating mines		49	48
Ore milled	thousand short tons	77,475	78,795
Production of gold:			
Gross weight	thousand troy ounces	29,971	30,759
Per ton of ore milled	troy ounce	0.3868	0.3905
Number of uranium-producing mines		8	8
Ore treated for uranium recovery	thousand short tons	10,500	13,656
Production of uranium oxide (U_3O_8):			
Gross weight	thousand pounds	6,427	7,766
Per ton of ore milled	pound	0.61	0.57
Average realized gold price per ounce		$35.22	$35.04
Working profit, gold and uranium	thousands	$431,126	$436,962
Taxes and lease fees payable to Government	do.	$167,934	$160,693
Net dividends	do.	$171,451	$158,816
Average number of employees in service:			
Whites		42,296	40,491
Nonwhites		361,893	368,135
Mine development, including shaft sinking	thousand feet	3,023	2,941
Ore reserves, payable	thousand short tons	167,029	159,060
Average grade of reserves	troy ounce per ton	0.470	0.467

Source: Chamber of Mines, Transvaal and Orange Free State, published by Union Corp., Ltd., Report and Accounts, 1968.

officials offered an interim contract for 1 million tons of Sishen ore over a 3- to 4-year period preliminary to a large, long-term contract involving Kraaipan magnetite concentrate.

The Railways and Harbor Administration introduced new measures designed to reduce transportation costs and make iron ore more competitive in world markets. Effective October 1, actual handling charges for ore at Port Elizabeth were reduced from $0.84 to $0.64 per short ton, and overall port charges were reduced $0.32. New rail cars with better weight-to-tare ratio were planned. Port facilities for 200,000-deadweight-ton ore carriers and a direct reduction of railage rates were considered.[12]

In December the Japanese surveyed the Sishen mine and discussed rail and harbor facilities and rates. A contract reportedly was signed for 1 million tons over 3 years for seven Japanese mills, starting in early 1969.

Highveld Steel and Vanadium Corp. Ltd.—Partial production (23,000 tons per month) was started at Witbank, Transvaal, in February, when the first hot metal was tapped. Steelmaking and continuous casting started in July. Production of blooms and billets commenced in September. In October three of four basic oxygen furnaces were in operation on a three-shift-per-day basis, and the fourth furnace and the heavy section mill were commissioned in November.[13] Full rated capacity of 435,000 tons of pig iron, 270,000 tons of finished steel (structurals and rails), and 136,000 tons of semimanufactured products was scheduled for 1971. The $175 million project, controlled by Anglo American Corp., is a fully integrated iron, steel, and vanadium facility. (See section on Vanadium.)

Titaniferous, vanadiferous magnetite ore is produced at the Mapochs mine, near Roossenekal, 100 kilometers northeast of Middelburg, Transvaal, where output will be gradually expanded to 1 million tons in 1970.[14] Run-of-mine ore averages 55 to 57 percent iron, 12 to 15 percent TiO_2, and 1.4 to 1.9 percent V_2O_5. Ore reserves in the lease area total 200 million tons.

Other Companies.—SCAW Metals Ltd. inaugurated a new $14 million merchant rod and bar mill at its Germiston plant in September. Union Steel Corp. planned a $1.5 million-per-year investment in new production facilities.

Ferroalloys.—Extensive chromite reserves, probably the largest in the western world, and low-cost electric power were major factors in South Africa's expanding ferrochrome industry, which earned $21 million in foreign exchange during 1968. Four basic grades of ferrochrome were produced:

[12] U.S. Consulate General, Johannesburg, State Department Airgram A-614, Oct. 11, 1968, 2 pp.
[13] South African Digest. Dec. 20, 1968, p. 11.
[14] Mining Magazine. V. 118, No. 5, May 1968, pp. 333, 335.

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Charge chrome, ferrochrome silicon, and high- and low-carbon types. The most valuable of these grades is the low-carbon ferrochrome, which has an average chromium content of about 70 percent.

The industry is dominated by five companies whose combined capital investment is estimated at $28 million. Palmiet Chrome Corp. (Pty.) Ltd., with General Mining and Finance Corp. Ltd. as the main shareholder, and RMB Alloys Ltd., established by Rand Mines Ltd. and the IDC, led the field with annual exports of each exceeding $7 million. They are followed by Transalloys Ltd., owned by the Anglo American Corp., Avesta Jernverks, a Swedish company, and African Metals Corp. Transalloys specializes in charge chrome production.

More than 95 percent of the Republic's ferrochrome is exported, largely to the United States, followed by the United Kingdom, Japan, Canada, and West Germany. In spite of statutory increases in the cost of labor, raw materials, and equipment, the industry reduced production costs significantly during the year.

Early in the year, the United States Steel Corp. successfully concluded negotiations for the purchase of a 31-percent share interest in Ferroalloys Ltd. and a 30-percent interest in Zeerust Chrome Mines Ltd. Both companies are members of the Anglo Transvaal Group, which planned to expand its activities in chromite and ferroalloy production.

A new company, Heavy Media Materials (Pty.) Ltd. was formed by African Metals Corp. (52 percent), Farbwerke Hoechst A.G. Vormals (26 percent), and ISCOR (22 percent) to produce special processed ferrosilicon at Kookfontein at a rate of 3,000 tons per year.[15]

Manganese.—Associated Manganese Mines of South Africa Ltd., a company of the Anglo Transvaal Group, was again the principal producer of manganese ore and ferromanganese. The company shipped 892,000 tons of ore. Ferroalloys Ltd., a subsidiary company, produced and marketed ferromanganese. Profits were lower due to decreased sales prices, which were not offset by increased tonnages sold or reduction in mining costs.[16]

Nickel.—A nickel refinery reportedly was under construction at East Geduld, Transvaal, by Union Corp. Ltd. as part of its platinum refining installations. Rustenburg Platinum Mines Ltd. produced nickel at a rate of about 5,500 tons per year.

Platinum.—*Rustenburg Platinum Mines Ltd. (RPM).*—The Rustenburg mine, the world's largest worked primarily for platinum group metals, continued its policy of not disclosing production data. Metal content of ore produced was believed to be on the order of 850,000 ounces in 1968. Net revenue on metal sales for the year ended August 31, 1968, was $43.7 million, and profit available for appropriation was $29.8 million.

Following a 1967 world market survey, RPM embarked on a $42 million expansion program aimed at an annual output of 850,000 ounces by the end of 1969, 950,000 ounces by early 1970, and 1 million ounces by the end of 1970.

Four vertical shafts have been sunk to 450 meters and sinking of two deeper shafts (700 meters and 1,000 meters) was underway as part of the expansion program. Converter matte or "white metal" is treated by Matte Smelters Ltd. near the mine site. The resulting anode slimes are shipped to Johnson, Matthey & Co. Ltd., London, for final refining. This United Kingdom firm is coowner of Matte Smelters with RPM. A refinery is under construction (RPM 20 percent; Johnson, Matthey 80 percent) at Wadeville and was expected to be completed about mid-1969.

Impala Platinum Mines Ltd.—This company, formed by Union Corp. Ltd., continued development of its Bafokeng mine in the Rustenburg district. Three pairs of inclined shafts were completed, and construction of concentrator and smelter plants was reported to be ahead of schedule. Total estimated cost for the project was $50 million. Impala planned an initial annual production rate of 100,000 ounces of platinum, 1,200 tons of nickel, and about 900 tons of copper by the end of 1969.[17]

South Africa's second platinum refinery was under construction by Union Corp. Ltd. at its East Geduld gold mine, near Springs, Transvaal. Production was scheduled for late 1969 or early 1970. Impala acquired controlling interest in Ayrton

[15] American Metal Market. V. 75, No. 182, Sept. 20, 1968, p. 13.
[16] Associated Manganese Mines of South Africa Ltd. Annual Report. 1968, p. 3.
[17] South African Mining and Engineering Journal, November 15, 1968, pp. 1156–1158.

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Metals Ltd., a British company dealing in platinum and allied metals, as a marketing organization.

Union Corp. Ltd. also announced increased osmiridium recovery to about 14,000 ounces per year at the East Geduld laboratory, doubling the former estimated output rate.[18] The source is gold ore from the Evander mine.

Anglo Transvaal Consolidated Investment Corp. Ltd.—In September, Anglo Transvaal announced a platinum discovery in the Lydenburg area of the Transvaal and applied for mining leases.

Tin.—The Republic's first electrolytic tinning line, a $14 million installation by ISCOR at its Vanderbijlpark steel plant, completed test runs and was in commercial production. The line is capable of 2,000 feet per minute and has increased tinplate capacity sixfold. Tin concentrates are from the Uis mine in the Territory of South-West Africa.[19]

Uranium.—Production was under expansion as several producers planned new operations. Eight companies produced uranium from 15 mines in 1968. Only one, West Rand Consolidated Mines Ltd., was primarily a uranium producer with by-product gold. Extensive research was underway on uranium recovery from ores, tailings dumps, and slime dams. At the beginning of the year, the United Kingdom had a long-term contract with the Republic of South Africa for uranium; West Germany, Switzerland, and France were customers; and Japan was negotiating for a contract.

In 1967 the Atomic Energy Act had been amended to permit private ownership of uranium in the South African mining industry. Early in 1968, uranium producers established Nuclear Fuels Corp. of South Africa (Pty.) Ltd. (NUFCOR) for the processing and marketing of uranium produced in the country. NUFCOR assumed the contractual responsibilities formerly held by the Atomic Energy Board, which continued to exercise Government jurisdiction over matters involving national security and international safeguard obligations.[20]

Anglo American Corp. produced 1,252 tons of uranium oxide (U_3O_8) during its 1968 financial year (ending September 30). A $4.8 million, 63,000-ton-per-month uranium extraction plant was planned at the Western Deep Levels gold mine. Operation was scheduled for mid-1970. The company tested heavy-media separation for gold-uranium values in ore at all of its mines. A new heavy-media plant was commissioned at the Saaiplaas gold mine, Orange Free State, and others were planned.[21]

Harmony Gold Mining Co. Ltd., a subsidiary of Rand Mines Ltd., reported substantial savings in production costs by solvent extraction of uranium at its 160,000-ton-per-month plant. This was the first South African production of high-purity uranium on a large scale. France reportedly renewed a 5-year contract with the company.

Vaal Reefs recommissioned a uranium extraction plant operating on 90,000 tons of slimes per month, a joint venture with nearby Western Reefs.

West Rand Consolidated conducted experiments on uranium recovery from abandoned mine stopes by bacterial leaching.

Table 9.—Republic of South Africa: Uranium production, 1968

Gold-uranium producer	Gold ore treated (thousand short tons)	Production (pounds U_3O_8)	Grade (pounds per ton)
Buffelsfontein	2,424	1,260,624	0.520
Harmony	2,018	626,200	.310
Hartebeestfontein	2,115	910,229	.430
Vaal Reefs	1,308	835,158	.638
Virginia	1,440	808,731	.562
Western Reefs	2,655	1,563,840	.589
West Rand Consolidated	901	1,226,923	1.362
Zandpan	795	534,058	.672
Total or average	13,656	7,765,763	.569

Source: Chamber of Mines of South Africa.

Vanadium.—Anglo American Corp.'s Highveld Steel and Vanadium Corp. produced its first vanadium slag in April, and in August consigned its first trial shipment to Europe. In October, a trial shipment of the slag was made to Foote Minerals Co., the major U.S. customer, for direct reduction to ferrovanadium. Highveld officials estimated annual output of 23 million

[18] U.S. Consulate General, Johannesburg. State Dept. Airgram A-627, Nov. 22, 1968, 2 pp.
[19] Tin International. V. 41, May 1968, p. 121.
[20] U.S. Consulate General, Johannesburg. State Department Airgram A-306, Feb. 14, 1968, 2 pp and enclosures.
[21] New Scientist. V. 41, No. 632, Jan. 16, 1969, p. 114.

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pounds V_2O_5 in slag when full production is attained.

A fall-off in world demand for vanadium, which started in late 1967, continued through the first months of 1968 and resulted in a decision to reduce output by 20 percent at Highveld's Vantra Division. The market recovered to some degree in the latter part of the year, and V_2O_5 stockpiles were at a low in November.

The Mapochs titaniferous magnetite orebody contains 1.4 to 1.9 percent V_2O_5. A similar deposit, but containing an average of 1.95 percent V_2O_5, was discovered at Kennedy's Vale and reportedly was leased from East Rand Consolidated Mines by Transvaal Vanadium Co. Ltd., a subsidiary of Highveld.[22]

Zinc.—Construction of the Republic's first electrolytic zinc plant near Springs, Transvaal, was near completion at yearend. First casting of slab zinc was set for April 1969. The $14 million plant was designed to produce 33,000 tons of high grade (and some special high grade) slab zinc from about 72,000 tons of concentrate from two mines in Territory of South-West Africa. The operating company, Zinc Corp. of South Africa Ltd. (ZINCOR), was formed in 1967 by ISCOR (35 percent), Gold Fields of South Africa Ltd. (33 percent), Vogelstruisbult Gold Mining Areas (whose uranium extraction plant was converted to the zinc refinery) (22 percent), and Kiln Products Ltd. (10 percent). ISCOR as the principal local consumer will benefit from the saving of about $12 million annually in foreign exchange, the import value of zinc from Zambia and Australia.[23]

NONMETALS

Asbestos.—The amosite mine of Cape Asbestos Co. Ltd. at Penge, eastern Transvaal, increased output to 88,225 tons in 1968. Two new mills at Penge, built during the 1966–68 expansion program, are the first in South Africa to incorporate dust suppression and collection systems operating continuously at constant water gauge. Marked success was achieved with new equipment for pressure-packing amosite for shipment.

Mine development and mill construction for chrysotile for Msauli Asbestos Ltd., near Barberton, eastern Transvaal, continued during 1968. The $6 million project, with construction by Premier Metal Co. of South Africa Ltd., was scheduled for completion by July 1969. The old mill facilities could not be converted economically to comply with health regulations. Msauli is owned by General Mining and Finance Corp. Ltd.

Cement.—Annual clinker capacity increased to 5 million tons with three new kilns in operation. Bulk sales continued to increase, mainly because of a growing number of large projects and reduced costs, and comprised about 25 percent of total sales. A total of 620 specially designed rail cars were in use for bulk haulage, and 200 more were on order. Research was underway on new mixtures, using varying percentages of blast-furnace slag. Cement makers sought a price rise.

Anglo-Alpha Cement Ltd., which produces about 40 percent of South Africa's total output, planned a $2 million, 200,000-ton expansion of annual capacity to 1.9 million tons.[24] The company operated its five plants at full capacity and designed plans for doubling capacity. Its Lichtenburg plant has one of the world's largest kilns—170 meters long, 5 meters in diameter, and annual capacity of about 450,000 tons.[25]

White's South Africa Portland Cement Co. Ltd. installed a new 300,000-ton-per-year Humboldt kiln, 54 meters long and 3.8 meters in diameter, at its Lichtenburg plant.[26]

According to its annual review of consolidated accounts and operations for fiscal 1968 (ending June 30), Pretoria Portland Cement Co. commissioned a new dry-process kiln, mill, and ancillary equipment in June.

Diamond.—Increased output, record sales and profits, and discovery of new deposits highlighted another successful year for the South African diamond industry. The Premier mine, largest of the De Beers Consolidated Mines Ltd. group, overcame production difficulties to increase output by 54,739 carats. Production increases

[22] Mining Magazine. V. 119, No. 6, December 1968, pp. 464–467.
[23] U.S. Consulate General, Johannesburg. State Dept. Airgram A–67, Mar. 13, 1969, 7 pp. and enclosures.
[24] U.S. Consulate General, Johannesburg. State Dept. Airgram A–608, Oct. 3, 1968, 1 p.
[25] South African Mining and Engineering Journal. V. 79, No. 3923, Apr. 12, 1968, pp. 822–823.
[26] Pit and Quarry. V. 61, No. 1, July 1968, p. 161.

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were also recorded at the Finsch mine, which in its second full year of operation produced 398,995 carats more than in 1967, and from Namaqualand. At the Finsch, higher grade material was worked, and recovery methods were improved. A rich mining area was worked at Annex Kleinzee in Namaqualand. De Beers accounted for more than 90 percent of the Republic's diamond output in 1968.[27]

Sales of gem and industrial diamond by the Central Selling Organization (supplies largely from other countries) totaled $600.3 million, $108.4 million more than in 1967. A 2.5-percent price rise became effective in September.

Prospecting by De Beers proved a new deposit at Koingnaas in Namaqualand, northwestern Cape Province, and disclosed extensions to reserves already proved in the area. A pilot plant was commissioned at Koingnaas in October and will continue to treat the complex material mined until metallurgical tests provide information for design of a permanent plant. De Beers also decided to reopen the Koffiefontein mine, 100 kilometers south of Kimberley in the Orange Free State, where sampling indicated an economic operation if the export duty were rescinded. The Government granted a release from export duty, and plans were made for dewatering and stripping in the open pit.

Table 10.—Republic of South Africa: Diamond production of De Beers Consolidated Mines, Ltd.

(Carats)

Mine	1967	1968
Annex Kleinzee	132,197	227,858
Bultfontein	420,755	259,471
De Beers	294,691	222,337
Dreyer's Pan	171,142	209,590
Dutoitspan	169,915	189,705
Finsch	1,816,960	2,215,955
Gracesputs	15,042	29,784
Jagersfontein	102,188	106,578
Kimberley dumps	213,166	186,053
Langhoogte	28,538	26,135
Premier	2,376,879	2,431,618
Wesselton	500,625	518,685
Miscellaneous	3,724	2,507
Total	6,245,822	6,626,226

Source: De Beers Consolidated Mines Ltd., Annual Report, 1968.

Fertilizers and Chemicals.—*African Explosives & Chemical Industries Ltd. (AE & CI).*—The firm's new $8.4 million, 165,000-ton-per-year sulfuric acid plant went on stream at Modderfontein in September. One hundred percent acid will be made from pyrite, recovered from gold tailings, and will reduce dependence on imported sulfur, saving $4 million annually in foreign exchange.[28]

Late in the year, AE & CI reported plans for a $3 million, wet-process phosphoric acid plant at Somerset West, Cape Province, to be on stream in mid-1970, using phosphate rock from Phalaborwa.[29]

A 170,000-ton urea plant was completed by Continental Engineering N.V., Amsterdam, at Umbogintwini for AE & CI.[30]

African Metals Corp. (AMCOR).—Early in the year, AMCOR completed expansion of annual capacity to 63,000 tons of fused phosphate at its Kookfontein plant, Transvaal. An experimental 20-ton-per-day electric furnace for elemental phosphorus also was in operation.[31]

Phosphate Development Corp. Ltd. (FOSKOR).—During the financial year (ending June 25, 1968), Government-controlled FOSKOR mined 7.7 million tons of phosphate rock (2 million tons more than in 1967) and 812,000 tons of low-grade pyroxenite at Phalaborwa. The final stage of the $11 million expansion program was completed in May. At year-end FOSKOR considered new drying plants and larger storage and handling facilities. The company also conducted exploration for phosphate nodules along a 300-kilometer section of the Continental Shelf in the vicinity of Cape Agulhas in conjunction with the University of Cape Town.

Polyfos (Pty.) Ltd.—This company was formed by AMCOR (51 percent), Albright and Wilson Ltd. (25 percent), and AE & CI (24 percent) for a new 20,000-ton phosphate chemical plant at Meyerton, near Johannesburg.

Triomf Fertilizer and Chemical Industries Ltd.—Triomf placed a $2.4 million contract with Simon-Lodge (Pty.) Ltd., United Kingdom, for its third phosphoric acid plant in South Africa, a 46,000-ton facility at Potchefstroom, Transvaal. The

[27] De Beers Consolidated Mines Ltd. Annual Report, 1968, 38 pp.
[28] U.S. Consulate General, Johannesburg. State Dept. Airgram A-576, Sept. 7, 1968, 2 pp.
[29] Journal of World Phosphorus and Potassium. No. 39, January–February 1969, pp. 6–7.
[30] European Chemical News (London). V. 14, No. 341, Aug. 16, 1968, p. 8.
[31] Journal of World Phosphorus and Potassium. No. 34, March–April 1968, p. 8.

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plant, near completion at yearend, would permit the manufacture of triple superphosphate. Triomf's other installations in the area include facilities for sulfuric acid, simple superphosphate, and mixed fertilizers.[32]

Fluorspar.—Exports of acid grade fluorspar were valued at $1.2 million and of metallurgical grade, $1.1 million, in 1968. Production remained largely lump metallurgical grade despite a rapid increase in output of flotation acid grade. Because of the higher unit value of acid grade fluorspar, the problem of upgrading large resources in the Marico district, western Transvaal, received much attention. These deposits are associated with dolomite, which frustrates flotation.[33]

A survey by the Natural Resources Development Council established reserves of more than 300 million tons, of which 30 million tons average 44 percent CaF_2, and large untested resources.[34] Consumption in South Africa was about 14,000 tons in 1968, mostly in steelmaking and ceramics. Largest producer of acid-grade fluorspar was the Kromdrai mine of Vergenoeg Mining Co. (Pty.) Ltd., which was acquired by a West German group. The full capacity output rate, reached in late 1967, was 2,200 tons of 97 percent CaF_2 concentrate per month in a new flotation mill.

Late in the year, it was reported that Gold Fields of South Africa Ltd. planned a $4.2 million mine and flotation plant at Zwartkloof, central Transvaal, with annual capacity of 45,000 tons of acid-grade fluorspar.[35]

MINERAL FUELS

Coal.—Domestic sales totaled 48.8 million tons of bituminous coal and 0.7 million tons of anthracite for a total value of $126.4 million, compared with $113.5 million in 1967. Consumption in electric power generation, oil-from-coal, chemicals, and coking continued upward.

Reserves have been the subject of intensive reevaluation. In May the Atomic Energy Board, during an assessment of power needs, reported minable reserves at 11.5 billion tons,[36] and indicated that unless the structure of the industry undergoes a major change, reserves could become critical in 30 years.

A Department of Planning study revised reserves downward even more drastically. Previous estimates of 45 billion tons of proved extractable reserves were discounted following the Department's release of preliminary information indicating reserves of only 1.8 billion tons, sufficient for less than 40 years at the 1968 rate of production and 20 years for coking coal. Major problems were in mining techniques, marketing, and labor productivity.[37]

ISCOR and SASOL, both major coal consumers, conducted longwall mining research in their Durnacol mines and planned greater emphasis on this method.[38]

A rise of $0.28 per ton in the controlled price was approved in the last quarter of the year. The last previous price increase was allowed in April 1965, resulting in an average mine-head price of $1.95 per ton at Transvaal mines. Current difficulties resulting from higher working costs and shortages of skilled and semiskilled labor were not expected to be completely offset by the price rise.

In December Trans-Natal Coal Corp. Ltd. announced plans for the country's first open-pit coal mine as part of the Optimus operation in the eastern Transvaal. Trans-Natal will have a 60 percent interest and A. McAlphine & Son (Pty.) Ltd. 40 percent in the $7 million operation. Initial small-scale production was scheduled for September 1970; final planned capacity will be about 200,000 tons monthly. Work on the conventional underground mine at Optimus proceeded on schedule.

Coke.—As a result of recent research, South African coke has improved in quality, having lower ash content and more accurate sizing. However, further improvement would cost proportionately more and might have the effect of rapidly depleting already limited coking coal resources, according to S. Thomas, general manager of the Coal

[32] Journal of World Phosphorus and Potassium. No. 33, January–February 1968, p. 8.
[33] Industrial Minerals (London). No. 11, August 1968, p. 19.
[34] Industrial Minerals (London). No. 9, June 1968, pp. 25–26.
[35] Industrial Minerals (London). No. 15, December 1968, p. 30.
[36] Canadian Mining Journal. V. 89, No. 11, November 1968, p. 23.
[37] U.S. Consulate General, Johannesburg. State Dept. Airgram A–625, Oct. 18, 1968, 8 pp.
[38] Colliery Guardian. V. 217, No. 3, March 1969, p. 145.

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Bureau, and B. H. Davis, manager of Coke Producers (Pty.) Ltd. It was estimated that a further reduction of 1 percent in ash content would add 25 percent to overall costs.

Petroleum.—After nearly 3 years of widely scattered, unsuccessful prospecting, mainly under government auspices, exploration for oil and natural gas settled down to a coordinated intensive search. During 1967–68, the coastal area of South Africa was divided into 12 concessions, and by yearend 1968, major international companies and consortia were engaged in geophysical exploration for petroleum. First results of offshore surveys were reports confirming the existence of a sedimentary section 4,500 meters thick.

The Mining Rights Act of 1967 provided for prospecting leases and spelled out terms and conditions for exploitation. Taxes are a maximum 50 percent on net profits for crude oil and 40 percent for natural gas. A "first discovery" bonus permits a 50-percent discount on profits tax and waiver of royalty payment. Other benefits are 15- to 17-year leases, favorable monetary exchange facilities, a full rebate on customs duty, and participation in the South African market.

Southern Oil Exploration Corp. (Pty.) Ltd. (SOEKOR), the Government-owned company with overall responsibility for the onshore and offshore search, concentrated its efforts in the southern Karroo, northern Karroo platform, and the Algoa Bay area, near Port Elizabeth. Late in the year, SOEKOR operated seven drill rigs onshore and had five seismic teams at work, including one French team. SOEKOR planned expenditures of $7 million, about half of total estimated exploration costs in 1968, and estimated that about $28 million, largely private, would be spent on exploration in South Africa in 1970.

S.A. Superior Oil Co. and partners, Tenneco S.A. Inc., S.A. Highland Oil Co., and Africa Cities Service Co., spudded in South Africa's first offshore wildcat in its 8,080-square-kilometer offshore concession on the southern coast, south of Plettenberg Bay, following a year of survey work. The Glomar Sirte vessel commenced drilling in October in 117 meters of water.[39] SOEKOR has an option for up to 12.5 percent in any discovery against payment of a pro rata share of all prediscovery expenses of Superior and its partners.

Initial work on the $22 million extension to Caltex's Milnerton refinery, near Cape Town, was scheduled for early 1969. Mobil Refining Co. South Africa (Pty.) Ltd. announced plans for an $8 million expansion at its Wentworth refinery, near Durban. Expansion at the Shell South Africa (Pty.) Ltd.–BP Southern African (Pty.) Ltd. Durban refinery yielded an additional 5 million barrels of products in 1968. Shell-BP completed a $17 million lube oil refinery, adjacent to its Durban refinery, and produced a range of medium- and high-viscosity, paraffinic oils.

Construction of South Africa's fifth oil refinery, a $77 million, 50,000-barrel-per-day inland installation at Sasolburg, near Johannesburg, was scheduled to begin in mid-1969. Operating company will be National Petroleum Refiners of South Africa (Pty.) Ltd., a joint venture of SASOL, Total Refining South Africa Ltd., and the National Iranian Oil Co. (NIOC). NIOC will provide for 70 percent of crude oil requirements under a 15-year contract.[40] A 670-kilometer, 18-inch crude pipeline will be constructed connecting the Richards Bay tanker terminal to Sasolburg.[41] A Richards Bay development plan, presented to Parliament in March, would permit entry of the largest ships under virtually all weather conditions. The feasibility of single buoy mooring for the largest crude carriers was considered.

Trek Petroleum (Pty.) Ltd., the first wholly South African marketing company, went into operation in March. It had a 10-year supply contract with Shell-BP. Trek is a wholly owned subsidiary of Trekbeleggings, the holding company formed by General Mining and Finance Corp. Ltd., Federale Volksbeleggings Bpk., Shell, and BP.

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[39] Oil and Gas International. V. 8, No. 9, September 1968, pp. 127–128.
[40] World Petroleum. V. 39, No. 8, Aug. 1, 1968, p. 8.
[41] Petroleum Times. V. 73, No. 188, Jan. 3, 1969, pp. 42–43.

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The Mineral Industry of the Territory of South-West Africa

By Walter C. Woodmansee[1]

Although details are lacking, a high level of mineral exploration activity by both foreign and domestic companies prevailed in South-West Africa during 1968. In the mining sector, interest was mainly in copper, lead, zinc, tin, and uranium. High world prices were instrumental in the reopening of some mines. In the petroleum sector, exploration concessions were granted for six offshore areas and two onshore areas, and preliminary investigations were initiated.

Quantitative data on mineral production were not available, but value of output during 1968 was estimated at $200 million,[2] about 60 percent of which was from diamond mines. The mining sector also was estimated to have contributed about 40 percent of gross domestic product and about 50 percent of public revenue.

Some $80 to $90 million, about half of which was foreign, has been invested in the mining sector. In 1967 the South-West Africa Administration was empowered to require foreign investors (not including those from the Republic of South Africa) to offer up to 50 percent participation in South-West Africa operations. A consortium was granted exclusive prospecting rights for 5 years to a 22,000-square-kilometer tract from Klein Aub in the Rehoboth area, northeast to Gobabis and the Botswana border. This consortium agreed to pay a fee of $70,000 annually for the 5 years and spend a minimum of $350,000 per year on exploration. A 50-percent minimum participation by Republic of South Africa was required.[3]

The Odendaal Plan for water and mining development was furthered during the year. Approximately $200 million was spent on the Plan from 1964 through 1968. Under the Kunene Scheme, negotiations continued for joint South-West Africa-Portuguese development of the Kunene River, which borders Angola. However, plans appeared to have been scaled down and delayed. In September 1968, work was started on a $550,000 interim powerplant at Ruacana Falls. The Scheme also included plans for water development by well drilling, canals, pipelines, and water storage, and for exploration and geologic mapping in the mining sector.

PRODUCTION

Official statistical data on mineral production have not been available since 1966. Output data for 1967 and 1968 in table 1 therefore are estimates or were derived from annual reports of two major mining companies in South-West Africa—Consolidated Diamond Mines of South-West Africa Co. Ltd. (CDM) and Tsumeb Corp. Ltd. Neither company reported major changes in output during 1968. Other operating companies were involved in development or expansion, mainly for copper and zinc, and output of these two commodities was expected to increase in future years.

[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from South African rands (R) at a rate of R1.00 = US$1.40.

[3] Engineering and Mining Journal. V. 169, No. 4, April 1968, p. 176.

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Table 1.—South-West Africa: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Arsenic, white	--	--	40	e [2] 300	[2] 484
Beryllium, beryl, 10 to 12 percent BeO	7	52	22	NA	NA
Bismuth concentrate: Mine output:					
Gross weight, kilograms	4,726	587	6	NA	NA
Metal content, do	1,420	176	3	NA	NA
Cadmium:					
Mine output, metal content	99	108	108	[2] 256	[2] 214
Metal	--	33	132	[2] 166	[2] 168
Cesium, pollucite, gross weight, kilograms	--	--	1,079	NA	NA
Columbium and tantalum, concentrate, gross weight, kilograms	669	1,005	858	NA	NA
Copper:					
Mine output, metal content	35,106	39,423	38,924	e 38,000	e 37,000
Metal, blister	28,511	29,706	33,032	e 34,000	e 32,000
Germanium, oxide, recovered, kilograms	--	--	1,212	NA	NA
Gold, metal, troy ounces	32	14	--	--	--
Iron and steel, iron ore	9,481	32,835	37,910	e 38,000	e 38,000
Lead:					
Lead-vanadium concentrate	9,916	11,476	12,179	[2] 9,830	[2] 6,640
Mine output, metal content	94,368	87,806	85,044	e 70,000	e 60,000
Metal, primary, refined	47,795	66,035	75,275	[2] 73,553	[2] 61,193
Manganese, mine output, gross weight, 48 percent Mn	--	3,797	23,013	NA	NA
Molybdenum, mine output, gross weight, kilograms	--	--	209	NA	NA
Silver, mine output, metal content, recoverable [3] thousand troy ounces	1,436	1,541	1,517	1,450	1,350
Tin:					
Concentrate, long tons	359	490	718	e 730	e 750
Concentrate, with tungsten, do	659	588	607	631	628
Tungsten, scheelite, concentrate	(3)	1	1	NA	NA
Vanadium, metal content, lead-vanadate concentrate e	1,000	1,157	1,227	980	660
Zinc, mine output, metal content	32,034	29,879	28,242	e 40,000	e 60,000
NONMETALS					
Aragonite	--	--	r 15	NA	NA
Diamond:					
Gem e, thousand carats	1,387	1,491	1,583	1,531	1,552
Industrial e, do	154	155	176	170	170
Total, do	1,541	1,646	1,759	[4] 1,701	[4] 1,722
Feldspar, crude	1,923	2,318	1,197	NA	NA
Fertilizer materials, phosphatic, guana	418	1,406	1,833	NA	NA
Gem stones, semiprecious:					
Agate, kilograms	2,268	5,058	--	NA	NA
Amazonite, do	9,562	680	--	NA	NA
Amethyst quartz, do	52,367	2,595	112,128	NA	NA
Chalcedony, do	3,225	7,398	r 885	NA	NA
Jasper, do	3,084	360	512	NA	NA
Rose quartz, do	13,608	--	r 8,300	NA	NA
Sodalite, do	6,350	180	--	NA	NA
Tiger's eye, do	--	--	998	NA	NA
Tourmaline, do	16	2	16	NA	NA
Graphite	250	359	363	NA	NA
Kyanite and related materials	572	--	18	NA	NA
Lime	3,719	3,570	3,123	NA	NA
Lithium minerals:					
Amblygonite, 6 to 8 percent Li_2O	12	35	27	NA	NA
Lepidolite, 3 to 3.6 percent Li_2O	369	270	331	NA	NA
Petalite, 3 to 4 percent Li_2O	724	1,208	r 1,219	NA	NA
Mica, scrap	377	118	25	NA	NA
Salt, marine, thousand tons	98	98	64	e 100	e 110
Stone, sand and gravel, not elsewhere specified:					
Dimension stone, marble	1,490	1,113	272	NA	NA
Slate	642	1,053	195	NA	NA
Wollastonite	118	209	336	NA	NA

e Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, construction materials such as common clay, sand, and gravel are probably produced, but quantitative data are not available.

[2] Output of Tsumeb Corp. Ltd. for fiscal years ending June 30.

[3] Less than ½ unit.

[4] Output of Consolidated Diamond Mines of South-West Africa Ltd.

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TRADE

Foreign trade in metals and minerals has not been reported since 1966. Most minerals are produced for shipment to the Republic of South Africa and elsewhere; therefore, production approximately corresponds to exports.

COMMODITY REVIEW

METALS

Tsumeb Corp. Ltd., an important producer of copper, lead, zinc, cadmium, and silver, continued exploration and mine development at its Tsumeb and Kombat mines. At Tsumeb, the hoist was ordered for the new No. 7 internal shaft, and the DeWet shaft was being deepened to 4,300 feet. Modernization and reequipping of facilities were underway, including improved housing for African employees. Underground development totaled 8,449 feet of drift, crosscut, raise, and stope preparation during 1968. Underground exploratory and development drilling totaled 18,301 feet. Diamond drilling totaling 8,285 feet at the Tsumeb West prospect proved a reserve of 491,000 tons containing 1.4 percent copper. A total of 93,010 tons of hydraulic fill from mill tailings and 10,633 tons of sand fill were delivered to the mine. Ore reserves at Tsumeb as of June 30, 1968, were as follows:

	Thousand metric tons	Percent		
		Copper	Lead	Zinc
Positive ore	6,393	4.73	10.50	2.80
Tentative ore (34–41 levels)	2,622	3.80	5.71	1.53

At the Kombat East, West, and Central ore bodies, Tsumeb Corp. Ltd. performed 12,924 feet of drift, crosscut, raise, and stope preparation. Underground exploratory and development drilling totaled 44,327 feet. Ore reserves at the Kombat mine as of June 30, 1968, were as follows:

	Thousand metric tons	Percent	
		Copper	Lead
Positive	1,575	2.20	2.08
Probable	1,323	1.72	3.18

Tsumeb Exploration Co. Ltd. continued exploratory drilling in several other parts of the country.

Table 2.—South-West Africa: Operations of Tsumeb Corp. Ltd.

	Year ending June 30	
	1967	1968
Tsumeb mine and mill:		
Ore mined, gross weight, metric tons	r 720,667	576,523
Ore milled, gross weight, do		575,430
Metal content:		
Copper, percent	4.06	4.61
Lead, do	10.25	10.29
Zinc, do	3.26	2.99
Silver, grams per metric ton	r 61.6	73.1
Concentrate production:		
Lead concentrate:		
Gross weight, metric tons	120,888	109,143
Metal content:		
Copper, percent	6.93	7.76
Lead, do	54.03	46.53
Silver, grams per metric ton	r 112	129
Copper concentrate:		
Gross weight, metric tons	48,052	40,207
Metal content:		
Copper, percent	37.07	38.45
Lead, do	8.66	9.60
Silver, grams per metric ton	565	600
Zinc concentrate:		
Gross weight, metric tons	17,755	10,433
Metal content:		
Zinc, percent	56.95	52.04
Cadmium, do	1.25	1.08

See footnotes at end of table.

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Table 2.—South-West Africa: Operations of Tsumeb Corp. Ltd.—Continued

	Year ending June 30	
	1967	1968
Mill recovery (from all concentrates):		
Copper—percent of metal in ore milled	89.46	91.09
Lead—do	94.05	92.19
Zinc—do	48.05	31.56
Kombat mine and mill:		
Ore mined and milled:		
Gross weight—metric tons	r 312,621	298,587
Metal content:		
Copper—percent	2.51	2.86
Lead—do	1.85	1.81
Silver—grams per metric ton	r 18.2	16.5
Concentrate production:		
Copper concentrate:		
Gross weight—metric tons	22,810	24,196
Metal content:		
Copper—percent	32.15	32.79
Lead—do	3.82	4.69
Silver—grams per metric ton	r 222	170
Lead concentrate:		
Gross weight—metric tons	6,997	4,035
Metal content:		
Copper—percent	4.90	5.94
Lead—do	67.14	62.08
Silver—grams per metric ton	33.3	33.9
Mill recovery (from all concentrates):		
Copper—percent of metal in ore milled	97.70	97.42
Lead—do	96.18	94.46
Total ore output—metric tons	1,033,288	870,110
Total concentrate output—do	216,502	188,014
Total recoverable metal in concentrates:		
Lead—do	r 70,766	56,179
Copper—do	r 32,288	31,471
Zinc—do	8,403	4,511
Cadmium—do	256	214
Silver—troy ounces	1,449,763	1,349,741
Smelting and refining:		
Direct smelting ore—metric tons	----------	856
Average assay:		
Copper—percent	----------	28.57
Lead—do	----------	5.02
Silver—grams per metric ton	----------	374
Copper concentrates smelted—metric tons	72,258	65,095
Average assay:		
Copper—percent	35.41	36.32
Lead—do	7.16	7.78
Silver—grams per metric ton	476	485
Lead concentrates smelted—metric tons	130,626	115,318
Average assay:		
Copper—percent	6.91	7.65
Lead—do	54.40	47.65
Silver—grams per metric ton	120	130
Production:		
Copper, blister—metric tons	34,187	32,392
Average assay:		
Copper—percent	98.76	98.67
Silver—grams per metric ton	1,151	1,337
Lead, refined—metric tons	r 73,553	61,193
Silver—troy ounces	221,590	547,294
Cadmium, refined—metric tons	166	168
Sulfuric acid—do	1,538	1,531
Arsenic:		
Black oxide—do	3,175	2,340
White—do	e 300	484
Metal sales:		
All metals produced—thousands	$72,984	$59,844
Arsenic:		
Plus 98 percent As_2O_3—metric tons	629	1,305
90 to 98 percent As_2O_3—do	337	201
Cadmium—do	319	175
Copper, electrlytic (refined on toll)—do	36,583	30,784
Lead—do	88,459	65,013
Silver—troy ounces	1,832,816	1,780,713
Zinc—metric tons	5,654	3,251

e Estimate. r Revised.

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Arsenic.—A refinery furnace was completed and in operation at Tsumeb. Black oxide was produced from the roasting of 7,961 tons of reverberatory and converter baghouse dust during fiscal 1968. A second furnace was completed but was not placed in operation because of limited demand for the product.

Cadmium.—The cadmium plant at Tsumeb processed 5,195 tons of blast-furnace and sinter baghouse dust to produce 168 tons of refined cadmium in fiscal 1968.

Copper.—Output of blister at Tsumeb and electrolytic copper (refined on toll) were reduced during fiscal 1968. After completing 29,000 feet of surface drilling, Tsumeb Corp. Ltd. decided to reopen the Matchless cooper-pyrite mine near Windhoek although exploration there indicated copper values lower than expected. The company planned to spend $5 to $6 million on development. An existing 352-foot vertical shaft will be sunk to 1,200 feet, and a crushing plant, concentrator, and other facilities will be built. The project was scheduled for completion in 1970 with production at a rate of 12,500 tons of ore per month.[4] According to the company's annual report for fiscal 1968, reserves at the Matchless mine were 2.2 million tons, containing 1.71 percent copper and 12.04 percent sulfur in pyrite at a 1-percent cutoff for copper.

Production continued at the Klein Aub deposit, about 100 kilometers southwest of Rehoboth, by a joint venture of several companies in the Federale Mynbou group (Federale Mynbou Beperk-General Mining and Finance Corp. Ltd.). Milling of ore commenced in October 1966. The production rate in 1968 was 150,000 tons per year, yielding 6,000 tons of copper concentrates for export to Japan. Reserves were 1 million tons of ore containing 3 percent copper.

Navarro Exploration Co., a U.S.-based firm, continued exploration for copper and base metals in three concession areas. The company worked a small copper mine, concentrates from which were exported to Japan.

Kennecott Copper Corp. was granted a 3-year exploration concession to a tract near Windhoek and started geophysical and geochemical surveys and a drilling project. Four geologists were assigned to the project.

Lead and Zinc.—Production of concentrates and refined lead at Tsumeb Corp. Ltd. declined during fiscal 1968. South-West Africa Co. Ltd. (SWACO) reported production[5] at its Berg Aukas mine, near Grootfontein, in metric tons, as follows:

Concentrates	Year ending June 30	
	1967	1968
Lead and zinc	9,050	10,130
Lead vanadate	9,830	6,640
Mixed sulfides	5,960	7,740
Zinc silicate	19,730	23,800

SWACO was shifting from production of lead-vanadate concentrates to zinc sulfide and silicate as the vanadium values between the 5 and 8 levels were depleted. A $1.5 million second shaft was being sunk. A new $5.8 million Waelz kiln was installed near the mine and was operational late in the year as part of a $20 million expansion program to provide raw materials for a new 36,500-ton-per-year electrolytic zinc plant under construction in the Republic of South Africa. Zinc oxide will be produced at Berg Aukas at a rate of 120 tons daily, using residues from the flotation plant and zinc concentrates. SWACO ore reserves at Berg Aukas in mid-1968 were estimated at 1.8 million tons containing 5 percent Pb, 24 percent Zn, and 0.7 percent V_2O_5. Exploration was underway, some in partnership with Tsumeb Corp. Ltd.

The Rosh Pinar mine, 22 kilometers north of the Orange River in the southern part of the country, also will provide zinc concentrates to the electrolytic refinery in South Africa. The daily output rate is 300 tons of zinc concentrate and 25 tons of lead concentrate. Operator is Imcor Zinc (Pty.) Ltd., formed by Industrial Minerals Mining Corp. (Pty.) Ltd. (a wholly owned subsidiary of the South African Iron and Steel Industrial Corp. Ltd.—ISCOR). A highly automated concentrator was built by Fraser and Chalmers Ltd. of South Africa. Mine and plant are scheduled for full-scale production early in 1969. Reserves were 4 million tons proved ore and 1.6 million tons potential ore, containing 5.78 percent Zn.[6]

[4] Engineering and Mining Journal. V. 170, No. 1, January 1969, pp. 128, 130.
[5] Metal Bulletin. No. 5351, Nov. 22, 1968, pp. 22, 26.
[6] Metal Bulletin. No. 5283, Mar. 19, 1968, pp. 21–23.

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Etosha Minerals Co., a subsidiary of Brilund Mining Co. of Canada, planned a 15-hole, 18,000-foot drilling project in its concession area near Tsumeb. The project reportedly will be supervised by technical personnel from Penarroya, the French firm.

Tin and Tungsten.—According to the ISCOR annual report, Industrial Minerals Mining Corp. (Pty.) Ltd. (IMCOR), a wholly owned subsidiary, continued exploration and development at its Uis mine, near Brandberg, 190 kilometers north of Swakopmund. Ore treatment capacity was under expansion to 95,000 long tons per month, and a 110,000-ton-per-month rate was scheduled for 1972. Several changes were planned to improve tin recovery, including new crushing facilities. Ore reserves were established at 25 million long tons. Water supply from the Oaruru River was under development.

SWACO produced tin-wolfram concentrate at its Brandberg West mine at a rate similar to that of the previous year. Exploratory drilling, started in 1966, has proved additional and higher grade ore reserves. The new estimate was 6.6 million long tons at combined tin-tungsten grade of 0.27 percent. Concentrating capacity was expanded from 95,000 tons to 120,000 tons per year.[7]

NONMETALS

Cement.—Oryx Cement Corp. reportedly was granted a franchise by the South-West Africa Administration for a $7 to $8 million plant in the Karibib-Usakos area, near large limestone deposits.[8]

Diamond.—Operations of CDM, a De Beers-controlled company, are summarized as follows:

	Material processed, (thousand cubic meters)		Production, (thousand carats)	
	1967	1968	1967	1968
Onshore	4,712	4,642	1,446	1,490
Foreshore	539	522	120	150
Offshore	109	76	135	82
Total	5,360	5,240	1,701	1,722

In the onshore areas CDM continued its $14 million, 2-year project to expand crushing capacity. Four new crushing and treatment plants for handling the diamond-bearing conglomerate were planned; the first was completed late in 1968 and was placed in operation. The capacity of each is 150,000 tons per month. Costs per carat produced were reduced from $10.92 in 1967 to $10.22 in 1968.

In the foreshore area, an experiment was conducted to extend mining seaward to the low-water mark using a wall of concrete prisms. It was concluded that this procedure would be economic only in high-grade areas. Cost per carat produced was $15.54 in 1967 and $15.36 in 1968.

The offshore concession operations of Marine Diamond Corp. Ltd. (MDC), leased by CDM since 1967, continued unprofitable, although costs per carat produced were lowered from $55.00 in 1967 to $43.96 in 1968. Research continued on mining techniques. The Pomona, an electrically driven dredge with two heavy media recovery circuits, operated in Chameis Bay most of the year. MDC conducted underwater geophysical surveys and sampling to establish boundaries of diamond-bearing materials.

Tidal Diamonds S.W.A. (Pty.) Ltd., controlled by Getty Oil Co., held a one-third interest in CDM's Diamond Area No. 2, north of Luderitz. Operational and output data were not reported.

Fluorspar.—ISCOR considered resumption of mining at the Okuroso deposit, located a few kilometers from Otjiwarongo on the railroad linking Tsumeb and Walvis Bay. The deposit reportedly contains 5 million tons of ore averaging 50 percent CaF_2.[9]

Lithium.—Klückner K.G., West Germany, acquired majority interest in South-West Africa Lithium Mines Ltd., which has two lithium mines southeast of Karibib. A new flotation plant was planned for treating low-grade ores. These mines account for all the petalite and lepidolite, and half the amblygonite, produced in the Territory.[10] As a result of economic sanctions against Rhodesia, Japan was expected to purchase lithium produced in South-West Africa.

[7] Tin International. V. 42, January 1969, p. 16.
[8] South African Digest. Oct. 25, 1968, p. 7.
[9] Industrial Minerals. No. 15, December 1968, London, p. 30.
[10] Industrial Minerals. No. 8, May 1968, London, p. 27.

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Salt.—At Swakopmund, north of Walvis Bay, South-West Africa Salt Co. (Pty.) Ltd. produced 99 percent purity marine salt at a rate of 100,000 to 120,000 tons per year, mainly for shipment to Republic of South Africa.

Sulfur and Pyrite.—Pyrite is an important coproduct at the Matchless copper mine, near Windhoek, recently reopened by Tsumeb Corp. Ltd. It will be used in the manufacture of sulfuric acid.

MINERAL FUELS

Petroleum.—On August 30, tenders were closed for exploration concessions, offered by Southern Oil Exploration Corp. (South-West Africa) (Pty.) Ltd. (SWAKOR), established by the South-West Africa Administration, and concession winners and areas were announced. Six offshore areas covering 69,000 square kilometers and two onshore areas covering 156,000 square kilometers were awarded as follows: Shell Exploration South Africa (Pty.) Ltd. and BP Southern Africa Ltd.—onshore No. 1, offshore Nos. 4 and 5; De Beers Consolidated Mines Ltd. and Société Nationale des Pétroles d'Aquitaine—onshore No. 2; Gulf Oil Co. of South Africa Ltd.—offshore Nos. 3 and 6; Chevron Oil Co. of South-West Africa Co. Ltd.—offshore No. 7; and H.M. Mining and Exploration Co. Ltd., Syracuse Oils (United Kingdom) Ltd., and Woodford Oil and Gas Co. Ltd. —offshore No. 8.[11]

Exploration agreements are for 17 years at option of the operating company. Work must begin in 1969 and operators are obligated to spend $700,000 on surface exploration in each concession during the first 3 years and perform drilling during the next 2 years. All agreements provide that SWAKOR may become a partner if a discovery is made. Similar to conditions in the Republic of South Africa, the company making the first discovery would receive a 50-percent tax reduction. Concession holders pay no customs duties on imported exploration equipment. Conditions for expatriation of capital are favorable.

Etosha Petroleum Co., controlled by the Canadian-based Brilund Mining Co., conducted a geochemical survey of its concession area in the northern part of the country (north of latitude 20° N). Seismic work and drilling were planned for 1969.

[11] World Petroleum. V. 39, No. 13, December 1968, p. 20A.

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The Mineral Industry of Spain

By F. L. Klinger[1]

In a post-devaluation climate of Government controls on prices and wages, higher costs of imported goods and services, and a low level of private investment in the national economy, the Spanish mineral industry appeared to perform remarkably well in 1968. Production of most major commodities increased, in several cases to record levels, and while exports as a whole showed only modest gains, much of the increase in output appeared to be absorbed by a growing internal industrial demand. Government expenditures, and investment incentives under the National Development Plan, appeared to be the main stimulants. However, private investment in recent years was an important factor in the industry's improved performance in 1968, and was acknowledged to be essential if the objectives of the Development Plan are to be realized. While foreign capital was actively sought, Government policy appeared to restrict foreign ownership to less than 50 percent of new enterprises.

Low productivity continued to be a serious problem in coal, iron ore, and other mining sectors but a slow improvement was evident. At yearend, several large investment projects were underway, notably in iron and steel, copper, lead and zinc, pyrite, petroleum refining and cement, and the industry's prospects for continuing growth in 1969 appeared to be good.

PRODUCTION

Indices of production for various branches of the mineral industry in 1967 and 1968 were as follows:

Sector	(1962 = 100)	
	1967	1968 [1]
Mining:		
Coal and lignite	98.9	99.7
Metallic ores	84.5	101.7
Nonmetals	168.0	169.4
Manufacturing:		
Iron and steel	182.2	232.3
Nonferrous metals	135.1	151.1
Fertilizers	182.0	206.3
Cement (Portland)	194.2	228.0
Petroleum refineries	250.3	312.5

[1] Average of indices for 11 months.

Source: Boletín Mensual de Estadística (Madrid). V. 30, No. 291, March 1969, pp. 55–64.

[1] Physical scientist, Division of International Activities.

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Table 1.—Spain: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite	6,772	4,168	1,949	• 2,000	NA
Metal, primary	49,644	51,906	68,679	85,032	88,685
Antimony:					
Mine output, metal content	54	86	91	122	188
Metal (regulus)	287	167	289	265	NA
Arsenic, white	143	119	112	129	130
Bismuth, mine output, metal content kilograms	----------	259	• 1,265	44	316
Cadmium, metal do	60,219	62,082	• 60,000	46,000	• 60,000
Copper:					
Mine output, metal content	9,872	8,776	r 8,784	• 9,200	• 9,100
Metal:					
Blister	21,405	31,023	24,042	29,008	45,644
Refined:					
Electrolytic	46,710	47,029	58,217	72,243	79,345
Fire refined	3,254	11,683	r 9,612	r 5,169	
Gold:					
Mine output, metal content troy ounces	23,534	8,295	418	NA	NA
Metal do	27,601	8,874	418	NA	NA
Iron and steel:					
Iron ore and concentrate thousand tons	5,107	5,691	5,069	5,085	6,185
Pig iron do	1,903	2,338	2,158	2,684	2,779
Ferroalloys do	66	69	77	80	97
Steel, ingots and castings do	3,150	3,516	3,847	4,594	5,019
Steel semimanufactures:					
Hot rolled:					
Heavy sections thousand tons	428	556	633	1,495	874
Light sections do	297	683	770		1,035
Wire rod do	r 176	481	400	337	482
Sheets and plates do	703	738	668	1,065	1,348
Hoop and strip do	r 116	173	169	201	204
Railway track material do	118	98	91	82	70
Blanks, for tubes do	----------	68	74	49	75
Other do	r 427	419	412	• 30	33
Total, hot rolled do	2,265	3,161	3,217	• 3,259	4,121
Other:					
Castings and forgings, rough do	82	242	181	NA	160
Cold rolled sheet do	100	118	379	381	542
Tinplate do	55	93	94	NA	106
Lead:					
Mine output, metal content	58,383	56,640	63,433	62,628	71,299
Metal, primary	57,994	58,815	65,901	52,560	63,674
Manganese ore and concentrate	16,118	17,461	19,004	8,385	12,926
Mercury:					
Mine output, metal content 76-pound flasks	79,221	r 74,144	71,679	50,430	60,380
Metal do	78,322	74,661	70,054	49,227	57,262
Silver, metal thousand troy ounces	2,315	1,961	2,025	2,218	• 2,400
Tin:					
Mine output, metal content long tons	91	111	200	113	118
Metal, primary do	1,774	1,787	1,877	1,823	2,169
Titanium:					
Ilmenite concentrates	43,924	20,110	42,228	37,855	39,538
Dioxide	6,615	7,274	r 10,086	11,471	NA
Tungsten:					
Mine output, metal content	17	22	48	76	111
Metal	38	27	58	96	NA
Uranium oxide (U_3O_8) produced •	70	61	60	r 60	60
Zinc:					
Mine output, metal content	88,459	39,266	57,225	59,107	76,650
Metal, primary	64,431	53,516	53,730	70,407	75,387
NONMETALS					
Barite	59,138	55,465	• 55,000	• 40,000	• 55,000
Cement, hydraulic:					
Natural thousand tons	383	337	267	• 202	• 192
Other do	8,117	r 9,361	11,810	13,138	14,908
Chalk cubic meters	91,147	100,788	291,662	NA	NA
Clays:					
Bentonite	14,467	17,879	23,972	NA	NA
Kaolin, including china clay	140,927	146,713	191,039	• 200,000	NA
Other thousand cubic meters	2,430	2,602	3,085	NA	NA
Diatomite, including tripoli	11,346	11,912	• 16,000	• 16,000	NA
Earths, industrial, n.e.s	8,569	7,317	6,929	NA	NA
Feldspar	16,730	25,570	50,618	• 50,000	NA

See footnotes at end of table.

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Table 1.—Spain: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Fertilizer materials:					
Crude potash salts, K_2O content	344,652	430,589	484,927	571,042	615,822
Manufactured:					
Nitrogenous, nitrogen content	207,265	230,493	261,212	303,113	NA
Phosphatic, P_2O_5 content	326,571	350,697	305,284	r 310,727	• 308,000
Potassic, K_2O content •	310,000	405,000	445,000	534,000	570,000
Fluorspar:					
Acid grade—thousand tons	123	166	167	181	173
Metallurgical grade—do	26	55	57	62	83
Gypsum and anhydrite, crude •—do	2,810	3,044	3,242	3,300	3,350
Lime (quicklime and hydrated lime)—do	313	357	251	• 300	• 300
Magnesite, crude	93,326	100,647	• 110,000	• 100,000	NA
Meerschaum (saleable)	16,000	10,126	• 17,000	• 20,000	• 20,000
Pigments, natural mineral	20,170	21,243	• 16,000	NA	NA
Pumice	2,293	56,335	97,757	100,000	NA
Pyrite (including cupreous):					
Gross weight—thousand tons	2,393	2,424	2,418	2,291	2,408
Sulfur content—do	1,135	1,149	1,132	1,087	1,150
Quartz	r 93,309	r 141,011	154,942	NA	NA
Salt:					
Rock—thousand tons	733	795	808	• 800	NA
Marine, including other evaporated—thousand tons	1,191	1,062	946	• 1,000	NA
Stone, sand and gravel, n.e.s.:					
Stone, not further described:					
Calcareous:					
Dolomite—thousand cubic meters	177	143	146	NA	NA
Limestone—do	12,743	14,805	16,467	NA	NA
Marble—do	60	r 75	135	NA	NA
Marl and other—do	1,920	1,829	2,375	NA	NA
Quartzite—do	294	171	99	NA	NA
Other—do	1,291	2,323	3,229	NA	NA
Sand:					
Glass sand—do	349	275	318	NA	NA
Other—do	477	548	773	NA	NA
Gravel—do	691	930	1,240	NA	NA
Sulfur, elemental, refined, including sublimed	56,662	43,497	28,135	42,110	28,269
Sulfates, natural:					
Glauberite, Na_2SO_4 content	4,085	6,006	6,363	NA	NA
Thenardite Na_2SO_4 content	42,486	41,411	41,574	NA	NA
Talc and steatite	26,807	27,817	29,055	• 28,000	NA
MINERAL FUELS AND RELATED MATERIALS					
Asphalt and bitumen, natural (contained)	1,124	1,569	2,236	NA	NA
Carbon black	r 838	r 707	3,510	3,792	NA
Coal:					
Anthracite—thousand tons	2,680	2,775	2,743	2,774	2,783
Bituminous—do	9,515	10,168	10,130	9,571	9,450
Lignite—do	2,604	r 2,723	2,654	2,686	2,810
Coke:					
Metallurgical—do	2,569	2,755	r 2,799	2,885	3,433
Gas—do	180	r 100	78	55	6
Fuel briquets, all types—do	1,054	844	610	480	NA
Gas, manufactured—million cubic meters	401	r 426	464	536	632
Peat	14,592	13,315	12,154	NA	NA
Petroleum:					
Oil shale—thousand tons	712	630	224	NA	NA
Crude oil—do	---	---	28	84	150
Refinery products:					
From oil shale:					
Gas-oil and solvents—do	79	82	27	---	---
Lubricants—do	64	75	36	---	---
Other—do	14	18	6	---	---
From crude oil:					
Gasoline—do	1,204	1,454	1,723	2,228	2,937
Naphtha, processed—do	NA	159	206	652	718
Kerosine—do	406	336	498	328	438
Jet fuel—do	160	226	259	497	667
Distillate fuel oil—do	2,723	2,863	3,502	4,758	6,374
Residual fuel oil—do	5,622	6,715	7,882	9,983	12,808
Liquefied petroleum gas—do	326	379	438	467	648
Lubricants—do	44	48	84	159	176
Asphalt and bitumen—do	331	356	241	196	217
Industrial naphtha—do	233	219	308	465	619
Other—do	119	164	197	249	300
Total [1]—do	11,168	12,919	15,338	19,982	25,897

• Estimate. r Revised. NA Not available.

[1] Total is of listed figures only.

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TRADE

Relationships between the value of mineral commodity trade and total commodity trade for the last 3 years were as follows:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1966	150	1,254
1967	206	1,375
1968 [p]	295	1,589
Imports:		
1966	946	3,572
1967	893	3,453
1968	1,025	3,522

[p] Preliminary.
[1] Exluding gold.

Sources: 1966–67: United Nations (New York). 1968: Estadística del Comercio Exterior de España (Madrid).

Imports of crude oil, valued at $458 million, and exports of petroleum products, valued at $121 million, continued to be the major elements in mineral commodity trade in 1968. A reduction of $40 million in net imports of iron and steel was partly offset by an increase of $18 million in net imports of copper ores and metal, while a reduction of $11 million in imports of fertilizer materials was countered by increased imports of solid fuels. The value of exports of mercury (including oxides) was essentially unchanged, at $24 million, from the level of 1967.

In terms of value, West Germany, the Netherlands, and the United States remained the principal buyers of mineral commodities while Saudi Arabia and Libya were the ranking suppliers due to the influence of crude oil.

Table 2.—Spain: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum metal, including alloys:			
Scrap	140	113	Mainly to West Europe.
Unwrought	117	11,108	United States 5,029; Argentina 1,610.
Semimanufactures	3,212	4,628	United States 1,778; Sweden 840.
Antimony metal, including alloys, all forms	10	------	
Cadmium metal, including alloys, all forms. kilograms	3,705	45,181	France 39,880.
Copper:			
Matte	74	134	All to United Kingdom.
Metal, including alloys:			
Scrap	213	181	United Kingdom 138; Japan 30.
Unwrought and semimanufactures	20,254	36,150	Netherlands 22,660.
Iron and steel:			
Iron ore, except roasted pyrite. thousand tons	511	814	United Kingdom 540; West Germany 141; France 104.
Roasted pyrite do	519	774	West Germany 633; United Kingdom 98.
Metal:			
Pig iron, including cast iron do	90	15	All to Italy.
Ferroalloys do	12	13	United States 6; United Kingdom 5.
Steel, primary forms do	24	(1)	All to Japan.
Semimanufactures do	21	52	Bulgaria 29; Rumania 6.
Lead metal, including alloys, all forms	179	39	Netherlands 15.
Magnesium metal, including alloys and scrap	20	16	All to United States.
Mercury:			
Oxides	111	139	Netherlands 87; West Germany 15.
Metal 76-pound flasks	52,621	50,532	United States 14,533; West Germany 10,211.
Nickel metal, including alloys, all forms	19	61	Netherlands 26; West Germany 23.
Selenium, elemental kilograms	221	842	West Germany 782.
Silicon, elemental	953	91	All to West Germany.
Tin metal, including alloys:			
Scrap long tons	18	17	All to West Germany.
Unwrought and semimanufactures. do	44	96	United Kingdom 45; Netherlands 20.
Titanium:			
Ore and concentrate (ilmenite)	9,900	6,300	All to France.
Oxides	1,613	4,865	United States 3,967.
Tungsten:			
Ore and concentrate	74	187	United Kingdom 111; West Germany 61.
Metal, including alloys, all forms	14	26	Netherlands 19; West Germany 7.
Zinc:			
Ore and concentrate	6,157	12,617	France 7,283; Netherlands 2,724; West Germany 2,609.
Oxide	278	451	Italy 215; Colombia 165.
Metal, including alloys, all forms	1,965	13,909	West Germany 4,800; France 3,818; Portugal 2,042.

See footnotes at end of table.

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Table 2.—Spain: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Other:			
Ore and concentrate	13,511	8,505	All to France.
Ash and residues containing nonferrous metals.	337	12,518	West Germany 11,407.
Oxides, hydroxides and peroxides of metals n.e.s.	222	190	NA.
Metals, including alloys, all forms	11	2	All to France.
NONMETALS			
Abrasives, natural	965	1,055	Cuba 343; United Kingdom 255.
Asbestos	308	183	Belgium-Luxembourg 181.
Barite and witherite	49,040	23,152	United Kingdom 8,850; Poland 5,957.
Cement	15,598	19,649	Mainly to West Europe.
Clay and clay products:			
Crude clays:			
Bentonite	1,722	3,279	United Kingdom 2,560; Netherlands 571.
Kaolin (china clay)	18,512	3,991	Italy 3,031; West Germany 960.
Other	11,370	32,428	West Germany 14,058; Andorra 6,819.
Products:			
Refractory (including nonclay bricks).	2,025	1,565	Cuba 599; Algeria 535.
Nonrefractory	15,801	15,425	Mainly to West Europe.
Feldspar	800	930	All to France.
Fertilizer materials, manufactured:			
Nitrogenous	------	20,800	Belgium-Luxembourg 14,845.
Phosphatic	66,448	72,350	United Arab Republic 47,279; Cuba 24,000.
Potassic:			
Potassium chloride	445,151	526,664	Poland 98,128; Norway 82,919; United States 45,351; Italy 41,100; United Kingdom 32,462; Ireland 32,392; South Africa 32,190.
Potassium sulfate	7,450		
Ammonia	2,711	10,046	Denmark 4,422; Belgium-Luxembourg 4,011.
Fluorspar	130,373	171,220	United States 135,975; West Germany 27,531.
Gypsum and plasters	3,821	4,839	Mainly to West Europe.
Lime	493	367	All to Andorra.
Magnesite	16,047	10,428	West Germany 6,663; United Kingdom 3,213.
Meerschaum, amber, jet	5,887	8,885	France 6,589; United Kingdom 2,023.
Pigments, mineral:			
Natural, crude	623	1,503	France 1,265.
Iron oxides, processed	17,914	18,936	United Kingdom 3,453; United States 3,076.
Pyrite (gross weight)—thousand tons	827	701	West Germany 408; France 123.
Salt—do	319	301	Norway 60; Denmark 47.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	10,981	9,811	Italy 5,723; West Germany 1,480.
Slate	139	47	Andorra 37; United Kingdom 10.
Worked, all types	17,411	27,621	France 16,632; West Germany 8,225.
Dolomite, chiefly refractory grade	3,655	12,805	United Kingdom 8,117; Chile 3,500.
Quartz and quartzite	23,152	32,793	Norway 25,966; Sweden 3,922.
Sand, excluding metal bearing	18,652	25,140	All to West Europe.
Sulfur, elemental, all forms	878	579	All to Morocco.
Other nonmetals, n.e.s.	1,649	95	Japan 62; Portugal 10; Turkey 10.
MINERAL FUELS AND RELATED MATERIALS			
Coal and coke, including briquets.—thousand tons	13	23	Portugal 12; Tunisia 9.
Petroleum:			
Refinery products:			
Gasoline—do	175	483	Sweden 211; United Kingdom 200.
Kerosine and jet fuel—do	170	198	Netherlands 63; United States 37.
Distillate fuel oil—do	250	577	West Germany 173; Netherlands 109; Denmark 82.
Residual fuel oil—do	1,121	1,089	Netherlands 281; United States 247; United Kingdom 138.
Other—do	1	(1)	NA.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals.—do	82	13	All to United States.

NA Not available.
[1] Less than ½ unit.

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Table 3.—Spain: Imports of metals and minerals

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	77,552	64,697	Greece 40,779; Guyana 19,959.
Oxide and hydroxide	139,423	158,772	Guinea 61, 358; France 54,239; Guyana 32,225.
Metal, including alloys:			
Scrap	203	99	United States 74.
Unwrought	25,946	15,826	Canada 10,448; Norway 3,898.
Semimanufactures	12,623	10,460	West Germany 3,379; France 2,149; Belgium-Luxembourg 1,631.
Antimony:			
Ore and concentrate	310	65	All from Morocco.
Metal, including alloys, all forms	142	294	United Kingdom 108; Netherlands 77.
Arsenic:			
Trioxide, pentoxide and acids	1,055	739	France 560; Portugal 179.
Metal, including alloys, all forms	12	16	Mainly from Sweden.
Bismuth, metal, including alloys, all forms	10	12	West Germany 7.
Cadmium metal, including alloys, all forms. kilograms	21,240	3,403	Belgium 1,527; Netherlands 790.
Chromite	29,154	15,989	Republic of South Africa 11,917; Turkey 2,011; Cuba 1,934.
Copper:			
Ore and concentrate	22,823	33,805	Cyprus 21,721.
Matte	14,513	16,510	Israel 7,837; Chile 2,856.
Metal, including alloys:			
Scrap	19,683	11,178	West Germany 1,976; Canada 1,880
Unwrought:			
Blister and other unrefined, unalloyed.	15,589	19,985	Uganda 6,328; Republic of South Africa 6,241; West Germany 4,385; Turkey 2,935.
Refined, unalloyed	23,861	24,104	Belgium-Luxembourg 6,641; Chile 6,379; Zambia 5,748; United Kingdom 3,114.
Semimanufactures	17,383	6,466	United Kingdom 2,285; West Germany 1,078.
Iron and steel:			
Ore and concentrate, except roasted pyrite. thousand tons	570	598	Morocco 291; Mauritania 231.
Metal:			
Scrap do	383	351	United Kingdom 209; West Germany 70.
Pig iron, ferroalloys, and similar materials. do	25	22	Finland 7; Canada 3; Sweden 3.
Steel, primary forms:			
Coils for rerolling do	r 576	135	West Germany 43; Italy 25; France 16.
Other do	r 617	701	West Germany 316; Netherlands 76.
Semimanufactures:			
Bars, rods, angles, shapes, sections. do	159	140	West Germany 68; Italy 20.
Universals, plates and sheets:			
Heavy and medium plates and sheets, uncoated. do	96	56	West Germany 31; United Kingdom 11.
Light plates and sheets, uncoated. thousand tons	176	83	United Kingdom 29; West Germany 15.
Tinned plates and sheets. do	75	165	United Kingdom 49; West Germany 31.
Other coated plates and sheets. do	49	54	West Germany 21; United Kingdom 19.
Hoop and strip do	20	20	West Germany 8; France 5.
Tubes, pipes and fittings do	58	37	West Germany 13; France 9.
Other do	18	16	West Germany 5; France 5.
Lead:			
Ore and concentrate	3,768	-------	
Metal, including alloys:			
Unwrought, including scrap	14,722	464	Mexico 360; United Kingdom 61.
Semimanufactures	760	642	West Germany 344; Belgium-Luxembourg 282.
Magnesium metal, including alloys, all forms	353	350	Norway 132.
Manganese:			
Ore and concentrate	142,940	134,844	Republic of South Africa 30,279; Ivory Coast 28,758.
Oxides	662	558	Netherlands 199; United Kingdom 91.
Metal, including alloys	85	139	France 86; Republic of South Africa 52.
Molybdenum metal, including alloys, all forms.	8	6	Netherlands 3; France 2.

See footnotes at end of table.

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Table 3.—Spain: Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Nickel:			
Matte, speiss, and similar materials	471	245	United Kingdom 85; Canada 75.
Metal, including alloys:			
Unwrought, including scrap	1,197	1,522	United Kingdom 743; Canada 398.
Semimanufactures	1,106	1,066	France 302; West Germany 233.
Platinum-group metals, including alloys, value, thousands	$2,043	$633	NA.
Selenium, elemental, kilograms	6,489	5,983	Canada 2,926; West Germany 1,936.
Silicon, elemental	101	31	France 30.
Silver metal, including alloys:			
Unwrought and semimanufactures, thousand troy ounces	6,439	4,816	Mexico 2,933; Peru 759.
Rolled silver, do	35	52	West Germany 51.
Tellurium, elemental, kilograms	1,434	4,377	Canada 2,922; Peru 1,066.
Tin:			
Ore and concentrate, long tons	3,094	2,066	France 532; Bolivia 449; Australia 384.
Oxides, do	159	159	United Kingdom 95; West Germany 51.
Metal, including alloys, all forms, do	214	72	United Kingdom 50.
Titanium:			
Ore and concentrate	7,451	2,761	Portugal 1,950; Australia 784.
Oxides	5,438	5,667	West Germany 2,156; United Kingdom 1,586.
Tungsten:			
Ore and concentrate	136	116	Australia 111.
Metal, including alloys, all forms	10	6	West Germany 2; France 1.
Zinc:			
Ore and concentrate	39,283	40,975	Sweden 27,642; Finland 4,598.
Metal, including alloys:			
Unwrought and semimanufactures	4,740	147	Congo (Kinshasa) 100; West Germany 23.
Other	512	62	Netherlands 28.
Zirconium metal, including alloys, all forms, kilograms	50,991	1,105	United Kingdom 1,046.
Other:			
Ore and concentrate	12,511	7,514	Australia 7,048.
Ash and residues containing nonferrous metals	25,730	15,033	United Kingdom 2,711; United States 1,738.
Oxides and hydroxides and peroxides of metals n.e.s.	r 1,792	1,428	West Germany 483; United Kingdom 225.
Metals, including alloys, all forms:			
Alkali, alkaline earth and rare earth metals	r 118	18	France 9.
Pyrophoric alloys	r 12	7	West Germany 4.
Other base metals, including alloys, all forms	r 422	421	Netherlands 233; West Germany 43.
NONMETALS			
Abrasives, n.e.s.:			
Pumice, emery, natural corundum, etc.	430	1,932	Greece 1,664.
Dust and powder of precious and semiprecious stone, value, thousands	$81	$79	United Kingdom $54; Netherlands $11.
Grinding and polishing wheels and stones	975	797	West Germany 221; Italy 158.
Asbestos	75,634	47,936	Republic of South Africa 25,344; Canada 17,260.
Boron materials:			
Crude natural borates	13,368	17,080	United States 12,546; Turkey 4,503.
Oxide and acid	670	731	France 622; Italy 100.
Cement	1,559	833	Poland 179; Norway 131; France 130.
Chalk	4,341	5,055	France 3,397; Belgium-Luxembourg 1,350.
Clay and clay products:			
Crude clays n.e.s.:			
Bentonite	15,204	15,473	Morocco 7,961; United Kingdom 4,259.
Kaolin (china clay)	39,238	15,645	United Kingdom 14,737.
Other	24,606	56,389	United Kingdom 42,283; France 6,765.
Products:			
Refractory (including nonclay bricks)	53,853	44,029	United States 12,472; West Germany 10,568.
Nonrefractory	25,179	22,662	Portugal 10,050; Italy 8,903.
Cryolite and chiolite	1,161	1,170	All from Denmark.
Diamond, all grades:			
Gem, not set or strung, value, thousands	$1,038	$1,619	Belgium-Luxembourg $1,242.
Industrial, do	$776	$770	Belgium-Luxembourg $314; France $150.
Diatomite and other infusorial earths	1,821	1,512	United States 703; West Germany 350.

See footnotes at end of table.

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Table 3.—Spain: Imports of metals and minerals—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Feldspar	1,206	2,054	Portugal 1,415; France 448.
Fertilizer materials:			
Crude:			
Nitrogenous—thousand tons	120	71	All from Chile.
Phosphatic—do	1,171	1,173	Morocco 702; United States 262.
Manufactured:			
Nitrogenous—do	432	213	West Germany 69; Norway 42.
Phosphatic—do	48	44	Belgium-Luxembourg 25; France 18.
Other, including mixed—do	124	186	West Germany 67; Italy 25.
Ammonia—do	15	4	All from France.
Graphite, natural	941	773	West Germany 235; Madagascar 229.
Lime	2,269	3,950	United Kingdom 2,037; Portugal 1,526.
Magnesite	7,212	6,420	Austria 2,520; United Kingdom 1,724.
Mica, crude, including splittings and waste	565	696	Norway 183; India 101.
Pigments:			
Natural, crude	165	127	NA.
Iron oxides, processed	1,625	1,685	West Germany 1,494.
Precious and semiprecious stone, except diamond:			
Natural—value, thousands	r $457	$498	West Germany $210; Belgium-Luxembourg $168.
Manufactured—do	$177	$816	France $137; Switzerland $117.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	14,412	14,955	Italy 10,911; Portugal 2,970.
Slate	667	1,086	France 800.
Other, including granite, porphyry, sandstone.	8,179	6,423	Norway 1,776.
Worked, all types	1,851	2,393	Portugal 943; Italy 843.
Dolomite, chiefly refractory grade	1,172	1,607	Norway 1,538.
Gravel and crushed rock, including macadam.	15,281	3,711	France 1,572; Italy 1,036.
Quartz and quartzite	1,846	1,007	West Germany 484; Sweden 188.
Sand, excluding metal bearing	67,489	53,769	Belgium-Luxembourg 33,905.
Sulfur:			
Elemental, all forms	45,867	70,610	France 45,201; United States 10,625.
Sulfuric acid	32,570	26,705	Portugal 13,102; Italy 7,404.
Talc, steatite, soapstone, and pyrophyllite	2,530	2,456	France 1,097; Norway 817.
Other nonmetals, n.e.s.:			
Crude	11,274	22,396	Italy 7,691; United Kingdom 5,774.
Oxides and hydroxides of magnesium, strontium and barium.	376	448	France 157; United States 156.
Bromine, fluorine and iodine	100	101	West Germany 78; Chile 20.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,885	2,303	Albania 1,186; United States 590.
Carbon black	25,809	16,156	France 7,712; Netherlands 4,767.
Coal and briquets:			
Anthracite and bituminous coal—thousand tons	1,386	1,338	United States 961; Poland 189; West Germany 154.
Lignite and lignite briquets—do	71	86	All from France.
Coke and semicoke—do	67	126	West Germany 90; Italy 23.
Gas, natural—value, thousands	$10,436	$15,975	Mainly from France.
Hydrogen, helium and rare gases	90	235	United Kingdom 104; France 67.
Peat, including peat briquets	2,733	2,619	United Kingdom 1,196; Ireland 748.
Petroleum:			
Crude and partly refined—thousand tons	16,314	21,217	Saudi Arabia 7,883; Libya 3,693; Venezuela 2,974; Iraq 2,792.
Refinery products:			
Gasoline—do	63	62	Netherlands Antilles 28.
Kerosine and jet fuel—do	162	150	United Kingdom 38; France 30.
Distillate fuel oil—do	56	30	Italy 26; United Kingdom 2.
Residual fuel oil—do	205	95	Lebanon 18; Netherlands 16.
Lubricants—do	50	31	United Kingdom 7; Netherlands 7.
Other—do	109	182	United States 126; West Germany 26.
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals—do	r 40	36	United Kingdom 19; Netherlands 8.

r Revised. NA Not available.

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COMMODITY REVIEW

METALS

Aluminum.—Increased output of primary aluminum in 1968 resulted mainly from increased productive capacity of smelters at La Coruña (34,000 tons annually) and Sabiñánigo (13,200 tons annually) operated by Aluminio de Galicia S.A. (ALUMIGASA) and Earle Aluminio Español S.A. (ALUMESPA), respectively. Total output of these smelters in 1968 was 45,379 tons, about 10,000 tons more than was produced in 1967. Further expansions were reportedly planned. Groupe Pechiney of France held a controlling interest in both companies, with minority interests in ALUMIGASA held by the Ugine-Kuhlmann Group, and in ALUMESPA by Eduardo K. L. Earle S.A., and Empresa Nacional del Aluminio S.A. (ENDASA). The Kaiser Aluminum and Chemical Corp., also a minority participant, apparently disposed of its interests in 1968.

ENDASA accounted for the remainder of Spanish production, with outputs of 23,747 tons at Valladolid, 19,006 tons at Avilés, and 553 tons at San Juan de Nieva. Total annual capacity of the company's smelters (47,000 tons in 1968) was scheduled to increase to approximately 80,000 tons by 1971.

Alcan Aluminio Iberico S.A. (ALIBERICO), Spain's largest semifabricator of aluminum, was to be merged with ENDASA under an agreement between Alcan Aluminium Ltd. and Instituto Nacional de Industria (INI), the State industrial agency. Alcan, which owned 60 percent of ALIBERICO, will own 25 percent of ENDASA. Annual productive capacity of ALIBERICO was about 44,000 tons of aluminum sheet, extrusions, and tube.

Spanish consumption of primary aluminum in 1968 was reported to be 98,200 tons, by the Organization for Economic Cooperation and Development (OECD).

Copper.—The unusually large output of blister copper from Spanish smelters in 1968 was an indirect result of the long strike of copper workers in the United States, which idled many U.S. plants. Spain imported about 30,000 tons of copper concentrates and matte from the United States, compared with 2,000 tons in 1967.

Rio Tinto-Patiño S.A. (RTP) continued construction of a copper smelter and a refinery at Huelva. Initially, the plants will have an annual productive capacity of 55,000 tons of copper, of which 20,000 tons will be supplied from ores which the company was preparing to mine at Minas de Rio Tinto, and the rest will be supplied by imports. It appeared that part of the domestic ore would be supplied from pyritic deposits mined by Cía. Española de Minas de Rio Tinto S.A. (RTE), and part would come from the Cerro Colorado deposit now being developed by Rio Tinto-Patiño. The latter deposit was reported to contain 30 million tons of ore averaging 0.8 percent copper. By the end of 1970, RTP expected to produce copper at the rate of 30,000 tons annually, along with byproducts of 965,000 ounces of silver and 99,000 ounces of gold. RTP was reportedly investing $58 million in the Cerro Colorado development, while RTE was investing $37 million for expansion of facilities at Atalaya. RTE owned a 55-percent interest in RTP.

Iron Ore.—The Marquesada mine group in Granada accounted for about half of the 1.1-million-ton increase in Spanish production of iron ore in 1968. This property, operated by Compañia Andaluza de Minas, a subsidiary of Compagnie de Mokta of France, produced 1,569,000 tons in 1968 (1,013,000 in 1967) and was the principal Spanish producer.

Exports of iron ore rose by 43 percent to 1.17 million tons while the level of imports was essentially unchanged from that in 1967. Shipments to West Germany were 512,000 tons, and 479,000 tons went to the United Kingdom.

Although a large share of the increase in national output was produced at one mine, average mine productivity continued to rise. The average number of mines operating during 1968 was 125, compared with 134 in 1967 and 202 in 1964. This trend indicated slow but continuing progress in rationalization of the iron ore industry.

Under the Concerted Action Plan, the Government hoped to raise production of iron ore to an annual level of 13 million tons by 1973, and in 1968 was offering at least $50 million in low-interest, 10-year

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credits to stimulate new mining and beneficiation projects. Ten proposals were reportedly submitted for Government approval in 1968, including a plan by Altos Hornos de Vizcaya S.A. (AHV) to triple production of the Bodovalle mine, to 1 million tons annually by 1971, and a plan by INI and the Wagner and Vivaldi groups to build a pelletizing plant in León at San Miguel de Dueñas by 1972. The latter scheme would require annual supplies of 1 million tons of iron ore from Wagner mines and 1.2 million tons from the Vivaldi group. Other pelletizing or sintering plants were proposed by AHV and Cia. Minera de Sierra Menera. The total investment for all projects submitted was probably more than $100 million. While these proposals were being evaluated, actual investment in the iron ore sector in 1968 reportedly totaled $6.6 million.

The problems of restructuring and modernizing the industry appeared to be difficult, especially in view of competitive pressure from foreign producers, but the magnitude of Spanish ore resources was expected to permit considerable improvement of the present situation.

Iron and Steel.—Output and consumption of iron and steel continued to rise in 1968, influenced by strong domestic demand and growing productive capacity. Production of steel was 17 percent higher than in 1967, and a similar increase was expected in 1969. Imports declined to 1.43 million tons of steel equivalent; exports tripled, to 165,000 tons; and consumption was estimated at 6.5 million tons in 1968 (6.2 in 1967) and was expected to rise to 7.7 million tons in 1969. Apparent consumption of steel was fifth highest among West European countries, but specific consumption (approximately 200 kilograms per capita) was lower than most and indicated a large potential for growth.

Investments in the iron and steel industry have been relatively large in recent years, in relation to the quantity of crude steel produced and in total amount. Actual expenditures, in U.S. dollars per ton of crude steel produced, rose from 17.4 in 1962 to 41.3 in 1967, and the total expenditure in 1967 was second only to West Germany among OECD countries. This position may have been maintained in 1968, as $250 million was reportedly invested during the year. Investment, by sector, in 1966 and 1967 was as follows:

	Million dollars	
	1966	1967
Charge preparation	16.9	18.4
Pig iron	29.1	27.1
Crude steel	27.6	28.8
Rolling mills	54.8	55.0
Ancillary plant and other	14.5	56.9
Total	142.9	186.2

Table 4.—Spain: Salient statistics of iron and steel industry

(Thousand metric tons)

	1966	1967
Production:		
Sinter	1,400	1,840
Steel, crude; by process:		
Bessemer (acid)	222	171
Open-hearth	1,762	1,892
Electric	1,306	1,554
Linz-Donawitz (LD)	557	895
Total	3,847	[1] 4,512
By continuous casting	102	197
Consumption:		
Iron ore, direct to blast furnaces	[2] 2,545	3,825
Iron ore, in steel furnaces [2]	171	180
Coke, in blast furnaces	1,972	2,505
Scrap, in blast furnaces	38	48
Scrap, in steelmaking:		
Open hearth	902	968
Electric	1,373	1,633
LD	128	206
Employment—persons	61,601	66,715

[1] Total for 1967 differs from that shown in table 1; reason not identified.
[2] Source: Economic Commission for Europe. ST/ECE/Steel/26 (Steel Market in 1967).

Also: Organization for Economic Cooperation and Development (OECD). The Iron and Steel Industry in 1967 and Trends in 1968 (Statistical Annex). Paris, 1968.

Effective capacities for production of pig iron and crude steel in 1967 and 1968, and estimates for later years were as follows, in thousand metric tons:

Year	Pig iron	Crude steel
1967	3,350	6,205
1968	4,420	7,010
1969	5,175	8,395
1970	5,175	9,340

Source: OECD (Paris). The Iron and Steel Industry in 1967 and Trends in 1968. Tables 42, 43.

Altos Hornos de Vizcaya, S.A. in which United States Steel Corp. owns a 25-percent interest, raised its production of iron and steel by 17 percent in 1968 and increased output of rolled products by 34

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percent. The company installed two LD converters and an oxygen plant at the Sestao works and continued construction of the oxygen steelworks at Sagunto. A continuous casting plant with an annual capacity of 1 million tons was nearly completed by yearend. Output of steel was expected to increase to 1.8 million tons in 1969. At Avilés, Empresa Nacional Siderurgica S.A. (ENSIDESA) installed three 30-unit batteries of coke ovens, a second slabbing mill, and continued to expand port facilities.

Unión Siderurgicas Asturianas, S.A. (UNINSA) was constructing an integrated steelworks at Veriña, near Gijon. The first blast furnace was expected to come on-stream in mid-1970. Production capacity at Veriña was to be 1.7 million tons of steel annually.

Production of these companies in 1968 was as follows, in thousand metric tons:

	AHV	ENSIDESA	UNINSA
Pig iron	1,072	1,197	• 350
Crude steel	1,093	1,307	570
Rolled products	1,284	1,362	NA

• Estimate. NA Not available.

In mid-1968 the Government announced a plan to build a major steelworks at Sagunto. The proposed plant would have an annual output capacity of 10 million tons of steel and would require an investment of more than $3 billion.

Domestic steel prices, held down by Government controls since devaluation in late 1967, were reportedly 10 to 15 percent less than steel prices within Common Market countries and the United States. At the same time, the industry had to pay higher prices to import capital equipment for replacement and expansion of plant, and it was not able to increase revenue significantly by exports. The resulting cost-price squeeze was a serious problem.

Lead, Zinc and Associated Metals.—The increase in mine output of lead and zinc in 1968 came mainly from Cartagena and Reocin. At Cartagena, Sociedad Minera y Metalúrgia de Peñarroya-España continued development of its three open-pit mines in the La Unión district (Emilia, San Valentin, and Gloria) and apparently finished the project to increase milling capacity of the Roberto concentrator to 6,000 tons per day. Production from the new facilities pushed total company output of lead and zinc concentrates 60 percent above the level of 1967. Ore feed to the Roberto mill is low grade, averaging (in 1966) only 1.5 percent lead, 0.8 percent zinc, and 0.4 ounce silver per ton.

At Reocin, ore output by Compagnie Royale Asturienne des Mines (CRA) was about the same as in 1967 but the grade was considerably higher and production of lead and zinc concentrates increased by more than 40 percent.

In metal production, the Peñarroya smelter in Córdoba was operated at full capacity during the year and was mainly responsible for a 30-percent increase in output of lead by the company in 1968. Peñarroya was also increasing production capacity of the Cartagena smelter, to 60,000 tons annually, and completed the first phase of the expansion in 1968 by installing a new agglomeration plant. In Avilés, Asturiana de Zinc S.A., an affiliate of CRA, produced 53,000 tons of zinc at the San Juan de Nieva electrolysis plant, an increase of about 10 percent over the level of 1967. The higher output was due to additional production capacity which was installed in 1967.

Production of concentrate and metal in Spain, by Peñarroya and CRA, was as follows (in metric tons):

	Peñarroya		CRA [1]	
	1967	1968	1967	1968
Lead concentrates	25,040	33,819	7,800	9,704
Zinc concentrates	14,220	24,916	66,678	90,223
Lead, crude	32,736	42,116	3,561	5,149
Zinc, crude	------	--------	48,834	53,380
Cadmium (kilograms)	------	--------	40,400	45,200
Silver (kilograms)	41,055	42,005	--------	--------

[1] Including production of affiliated companies owned 25 to 50 percent by CRA.

Source: Company annual reports to stockholders for 1968.

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In other developments, CRA was preparing the Monte Romero mine in Huelva for production in 1970–71, and continued modernization of the Arnao zinc plant in Avilés. Peñarroya consolidated its Spanish operations in January, 1968, in a new firm, Sociedad Minera Metalúrgia Peñarroya-España.

Spanish consumption of refined metal in 1968, as reported by OECD, included 62,300 tons of lead and 53,100 tons of zinc.

Mercury.—While metal production increased by 16 percent in 1968, exports of mercury dropped 15 percent to 42,980 flasks, the lowest level in several years. West Germany and the United States remained the principal buyers, with 11,709 and 10,336 flasks respectively—an increase for West Germany but a 29-percent drop for the U.S. compared with 1967 levels. Exports also increased to Czechoslovakia, Sweden and Japan, but declined by 25 percent or more to France, the United Kingdom, Rumania, and Poland.

Output of cinnabar ore, most of which was mined at Almadén, increased by 12 percent in 1968 while production of arsenical ore, mined in Oviedo and León, rose by one-third. Average mercury content of cinnabar ore was 1.92 percent (1.80 in 1967) and of arsenical ore 0.22 percent (0.26 in 1967).

NONMETALS

Cement.—Production in 1968 was about 13 percent above the 1967 level and represented 86 percent of the industry's total capacity. Imports dropped by 500,000 tons.

In January, a new plant of 400,000 tons annual capacity was brought into production at Valencia by Cia. Valenciana de Cementos Portland S.A. The company produced 1 million tons of cement in 1967 from 2 plants in Valencia and Alicante.

Asland Asociada S.A. was building a 500,000-ton-annual-capacity plant in Barcelona, with completion scheduled by year-end 1969.

Cementos del Cantábrico S.A. planned to build a plant with 1.5 million tons annual capacity at Gijon. The first section, with an annual capacity of 750,000 tons, will be built by mid-1971 at an estimated cost of $20 million. The Ciments Lafarge Group of France was providing technical assistance.

At yearend, 51 companies were operating 64 plants with a total productive capacity of about 17.6 million tons annually and a total employment of approximately 12,000.

Fluorspar.—A large, uniform deposit of fluorspar was reportedly outlined in 1968 in Oviedo province, near Ribadasella. Part of the deposit, which is located at a depth of only 180 feet, underlies the village of Caravia. Neither the quantity of possible reserves nor the name of the developing company was specified.

Minerales y Productos Derivados S.A. produced 106,000 tons of wet filter cake in 1968, exported 91,000 tons, and sold 9,700 tons on the domestic market. This company, reportedly the largest producer of acid-grade fluorspar in West Europe, had a total annual production capacity of 150,000 tons, distributed among mines and plants at Osor (Gerona), Berja (Almería), Ribadasella (Oviedo), Castillo (Sevilla), and Turon (Granada).[2]

Exports of fluorspar in 1968 decreased to 139,000 tons, mainly because of reduced shipments to the United States (106,000 tons). Shipments to West Germany increased, to 29,000 tons.

Domestic consumption of fluorspar by the chemical industry was 42,424 tons in 1967 (35,487 tons in 1966).

Pyrite.—Production, exports, and consumption of pyrite increased in 1968. While production of individual companies was not available, 90 percent of Spanish output usually comes from the province of Huelva, and the remainder is derived from pyrite deposits in Sevilla and from lead-zinc-pyrite deposits in Santander and Murcia.

In Huelva, 1968 shipments by RTE totaled 1,079,000 tons (946,000 in 1967), while those by Tharsis Sulphur and Copper Co. Ltd. totaled 864,000 tons (686,000 in 1967). The 26-percent increase in shipments from Tharsis was destined almost entirely for export.

Exports in 1968 rose to 833,000 tons of pyrite and 770,000 tons of calcines. West Germany remained the largest buyer, with 70 percent of the total. Export prices for pyrite were about 50 percent higher than domestic prices, partly because of higher copper content in exported material and

[2] Industrial Minerals (London). No. 20, May 1969, p. 34.

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partly because domestic prices were controlled by the State.

Production of sulfuric acid rose by 12 percent, to 2,018,000 tons. Output of the RTE acid plant in Huelva was about 650 tons daily after midyear, and construction of a second unit, with a daily output capacity of 1,040 tons, was started by yearend. Approximately 10 percent of the pyrite shipped by RTE in 1968 was roasted at Huelva. In northern Spain, output of acid by Cie. Royale Asturienne des Mines was 106,000 tons, 40 percent more than in 1967.

Seventy percent of the sulfuric acid produced in 1967 was consumed by the fertilizer industry. In the same year 1,411,000 tons of pyrite was consumed in manufacture of basic inorganic chemicals, along with 11,000 tons of elemental sulfur.

Both of the major producing companies were expanding production capacity. RTE was installing new treatment and handling facilities in Huelva to raise output to 1.2 million tons annually, expandable to 1.8 million tons. The Tharsis company was combining mining operations at the North Lode, San Guillermo and Sierra Bullones deposits into one large open-pit. Overburden stripping, at the rate of 15,000 tons daily, was underway in 1968. The consolidated operation was expected to raise the company's annual output capacity to 2 million tons of pyrite, from the present level of 1.2 million tons.

In another development, deposits of cupriferous pyrite up to 80 feet wide were reportedly discovered in the Lapilla area of Huelva, by a subsidiary of INI.

MINERAL FUELS

Coal and Lignite.—The number of mines and total mine employment in the solid fuels industry was further reduced in 1968, as follows:

	Average, 1964	December 1967	December 1968
Number of mines:			
Bituminous coal	152	96	82
Anthracite	166	112	102
Lignite	104	56	50
Total	422	264	234
Total employment:			
Bituminous coal	58,394	47,785	45,437
Anthracite	16,890	13,683	13,441
Lignite	10,216	7,772	7,713
Total	85,500	69,190	66,591

Productivity (per underground man-shift) during 1968 was estimated at 1,235 kilograms for bituminous coal; 1,205 kilograms for anthracite; and 1,870 for lignite.

Due to increasing demand from the iron and steel industry and electric powerplants, and the decline in domestic coal production, imports of coal in 1968 increased to nearly 2.15 million tons, 51 percent more than in 1967. Imports from West Germany and the United States rose by 362,000 tons and 343,000 tons, respectively, while shipments from Poland increased by 110,000 tons. The United States remained the principal supplier but its share of the import market fell to 61.5 percent, compared with 73 percent in 1967.

Apparent consumption of coal increased about 6 percent, to 14.3 million tons in 1968, but due to the increasing use of petroleum, the share of coal in Spain's energy consumption declined to 27 percent, compared with nearly 30 percent in 1967.

Spanish consumption of coal, by sector, in thousand metric tons is shown by the following tabulation:

Consuming sector	1965	1967	1968
Thermal powerplants	2,789	3,176	• 3,500
Coking plants	3,968	3,600	• 4,700
Railways	836	500	
Iron and steel industry	660	550	
Patent fuel plants	784	350	• 6,100
Gas works	168	80	
Other industry	3,573	3,945	
Other	1,667	1,300	
Total	14,445	13,501	• 14,300

• Estimate.

Source (1965–67): OECD (Paris). Statistics of Energy 1953–67. 1969, pp. 254–258.

Natural Gas.—Imports of liquefied natural gas from Libya were expected to begin at Barcelona in 1969. Under a 15-year contract with the Standard Oil Co. of New Jersey, Catalán de Gas y Electricidad S.A. (CGE) will import about 1.14 billion cubic meters of gas annually.

Nuclear Energy and Uranium.—Spain's first nuclear powerplant went critical on June 30. Located at Zorita de los Canes, 40 miles northeast of Madrid, the plant has a rated generating capacity of 153 megawatts of electricity (MWe). The reactor is of the pressurized-water type, using enriched uranium fuel, and was built and installed for Unión Eléctrica Madrileña by the Westinghouse Electric Co. Full-capacity generation of power was not expected until late fall.

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A second powerplant, with a generating capacity of about 450 MWe, was reportedly under construction at Santa Maria de Garoña (near Burgos) and scheduled for completion in 1970. Construction of a third plant, with a generating capacity of 480 MWe, reportedly was begun by yearend at Vandellos, near Tarragona. In other developments, successful operation of a fuel reprocessing plant was announced in January by the Junta de Energia Nuclear (JEN); Spain's fifth research reactor went critical in March; and the feasibility of manufacturing nuclear fuel elements in Spain was being studied.

Exploration for uranium was continued by JEN. Prospecting was concentrated in the Cáceres region, also near Orense and Lugo in Galicia, and in the coastal region of Cataluña. Uranium was reportedly discovered in the western Pyrenees region, northwest of Pamplona, near Leiza.

Domestic reserves of uranium, in metric tons U_3O_8, were reported as follows:

Reserve category	Extractable at price ranges of ($U.S., per pound U_3O_8)		
	Below $10	$10–$15	$15–$30
"Reasonably assured"	10,000	3,600	13,600
"Possible supplementary"	-------	27,000	225,000

The Andújar concentration plant in Jaén continued to account for all U_3O_8 production. A second plant, with an annual output capacity of 300 metric tons U_3O_8, was scheduled for construction at Salamanca by 1972. The latter plant will process ore from the Ciudad Rodrigo deposits.

Petroleum.—*Exploration.*—An estimated $24 million was spent for oil and gas exploration in continental Spain in 1968, including $11 million in offshore areas. No commercial discoveries were reported. In late 1967, 19 mainland exploration permits were awarded jointly to Standard Oil of California and Texaco for areas in central Spain. In October, 1968, 10 permits for offshore exploration were awarded to Compañia Española de Petróleos S.A. (CEPSA) and the Belgian firm of Petrofina. Two dry holes were drilled offshore by Shell, one near Tarragona and one in the Bay of Cadiz. Traces of gas were reported.

Crude Oil Refining.—Imports of crude oil again rose nearly 30 percent and totaled about 28 million tons. Saudia Arabia remained the largest supplier (10 million tons), while imports from Libya nearly doubled, to 7.1 million tons. Venezuela and Iraq supplied about 3.5 million tons each, and about 3 million tons came from Kuwait and Iran. Continental Spain received 20.5 million tons and the remainder was imported at Tenerife.

Hispanoil, the organization of Spanish State-controlled oil companies, continued to negotiate barter agreements in oil-producing countries. The firm was associated with exploration groups in Libya, Kuwait, and Iran in 1968 and hoped to participate in ventures in Saudi Arabia, Venezuela, and Algeria. Hispanoil had the right to designate the source for 20 percent of Spain's imports of crude oil for the domestic market in 1968, but this share was expected to increase to about 30 percent in 1969. Barter agreements accounted for about 8 percent of oil imports in 1968.

In refining, the capacity of plants at Castellón, Puertollano, and Cartagena was being increased in 1968 and further expansions were planned. The CEPSA refinery at Algeciras, with a processing capacity of 4 million tons of crude oil annually, was nearly completed at yearend. Total refining capacity was close to 35 million tons annually by the end of 1968.

In September, Gulf Oil Co. was awarded the right to build a 5-million-ton refinery at Bilbao. Gulf will have a 40-percent interest, and Campsa, the State marketing monopoly, will own 30 percent. Cost of

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the refinery was estimated at $84 million. International bidding was expected to open, early in 1969, for a refinery of similar capacity, to be located at Barcelona.

In March, 1968, Government policy was defined concerning foreign ownership of refineries in Spain. Percentage of ownership will be limited to 40 percent. A company has the right to specify the source of crude oil, equivalent to the share of ownership.

Consumption of liquid fuels, and of fuel oils by consuming sector, in 1966 and 1967 is shown by the following tabulations, in thousand metric tons:

	1966	1967
Fuel:		
Gasoline	1,525	1,828
Kerosine	271	250
Jet fuel	312	378
Fuel oils	8,637	11,490
Liquefied petroleum gas	761	892
Refinery fuel	700	800
Total	12,206	15,638
Fuel oils, by sector:		
Thermal powerplants	1,925	2,147
Gas works	98	210
Transport:		
Highway	1,780	3,007
Railroad	672	898
Inland waterways	637	931
Industry	2,260	3,472
Others	1,280	825
Total	8,637	11,490

Source: OECD (Paris). Statistics of Energy 1953–67. 1969, pp. 257–259.

Inland consumption of all finished petroleum products increased by 25 percent in 1968, to 18.6 million tons.

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The Mineral Industry of Sweden

By F. L. Klinger [1] and Bernadette Michalski [2]

Rational planning, investment in advanced technology, and strong foreign and domestic demand continued to stimulate high levels of output and productivity in the Swedish mineral industry. A large increase in production and exports of iron ore, Sweden's principal crude mineral commodity, and the beginning of large-scale production of extremely low-grade copper ore from an open pit mine under arctic conditions, were the most visible results in 1968 of the efficiencies made possible by mechanization, automation, and improved beneficiation facilities in Swedish mines and plants, and by continuing refinement of transportation systems. Less spectacular but significant improvements were also being made in mining, concentration, and smelting of nonferrous metal ores and pyrite; in rationalization of the sulfuric acid and fertilizer industries; and in manufacture of iron, steel, and cement.

In the energy sector, the first full year of production from new refineries in western Sweden resulted in heavy increases in output of petroleum products and in imports of crude oil. Thermal powerplants increased in importance as the development of hydropower resources was close to economic limits. The country's first large nuclear powerplant was completed; a second was nearing completion; and firm plans were made to build three more by 1974.

Except in construction materials, gains in production by sectors of the mineral industry exceeded or kept pace with the estimated 4.5-percent growth in gross national product in 1968. Although wages were expected to rise about 9 percent as new labor contracts were negotiated, increased investment was indicated, and industrial output (including construction) was expected to rise by 3 to 9 percent in 1969.

PRODUCTION

A comparison of the volume of production in different sectors of the mineral industry in 1967 and 1968 is shown in the following tabulation:

Industry sector	(1959 = 100) 1967	1968
Iron ore mining	167	191
All mining and quarrying	158	175
Primary metals	185	199
Nonmetallic mineral manufacturing	180	186
Products of coal and petroleum	210	e 320
Chemical industry [1]	225	251
All industry	170	178

e Estimate.
[1] Includes fertilizers and products of coal and petroleum.

Principal source: Central Bureau of Statistics (SCB) (Stockholm). Statistiska Meddelanden. I, 1969: p. 24–1 (9); August. 7, 1969.

The volume of investment, at current prices, in Swedish industry in 1968 was approximately the same as in 1967, but substantial increases were expected in 1969. Actual and planned public and private investment (excluding repairs and maintenance) in 1968 and 1969 was estimated as follows, in million dollars:

Industry sector	1968	1969
Mining and quarrying	49.1	52.0
Nonmetallic mineral manufacturing	57.3	80.0
Primary metal works	101.3	127.6
Chemical industry	130.0	153.0
All manufacturing	1,444.0	1,630.0

Source: SCB (Stockholm). Statistiska Meddelanden. I, 1969: 11; p. 1(22) May 6, 1969.

[1] Physical scientist, Division of International Activities.
[2] Foreign mineral specialist, Division of International Activities.

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Table 1.—Sweden: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum metal:					
Primary	32,286	31,714	28,679	r 33,441	55,800
Secondary, including alloys	51,223	40,542	45,662	50,712	NA
Arsenic, white	17,970	16,500	14,700	20,200	21,100
Bismuth e	68	35	35	30	NA
Cobalt metal	3	1	4	3	e 3
Copper:					
Mine output, metal content	16,190	15,787	15,277	15,285	18,200
Matte	--------	--------	--------	1,572	200
Cement	970	921	871	731	400
Refined:					
Primary, electrolytic [1]	45,652	50,548	r 51,208	r 47,691	46,600
Secondary	28,757	30,370	24,066	37,011	NA
Gold:					
Mine output, metal content—troy ounces	117,672	118,090	79,573	60,668	49,737
Metal, including alloys—do	161,107	154,259	r 151,301	r 117,446	106,097
Iron and steel:					
Iron ore and concentrate:					
Ore, direct shipping—thousand tons	22,685	24,876	22,243	r 22,450	r 26,632
Concentrates—do	3,934	4,478	5,744	5,887	5,788
Total—do	26,619	29,354	27,987	r 28,337	r 32,420
Roasted pyrite—do	296	170	r 227	264	198
Pig iron—do	2,178	2,287	2,229	2,362	2,495
Sponge iron—do	152	176	171	152	152
Ferroalloys—do	158	171	173	209	230
Steel:					
Ingots—do	4,384	4,620	4,594	4,433	4,456
Billets—do		43	105	286	583
Castings—do	60	64	63	49	56
Total crude steel—do	4,444	4,727	4,762	4,768	5,095
Alloy and high-carbon steel—do	r 1,104	r 1,222	r 1,236	r 1,141	1,306
Steel semimanufactures:					
Bars, rods, sections—do	1,369	1,457	1,442	r 1,548	1,627
Plates and sheets—do	805	r 871	r 928	r 1,008	1,077
Strip—do	384	421	480	494	529
Rails and accessories—do	69	70	65	43	38
Seamless tubes—do	206	235	229	204	218
Other—do	228	194	203	143	143
Total semimanufactures—do	3,061	3,248	3,347	3,440	3,632
Lead:					
Mine output, metal content	67,470	68,950	r 70,886	r 73,600	72,000
Metal, refined:					
Primary	40,353	40,230	43,700	42,000	41,900
Secondary	8,374	10,178	10,648	11,813	NA
Manganese ore (13 to 15 percent manganese)	5,944	25,949	21,650	18,814	11,700
Selenium, elemental	82	80	70	60	e r 85
Silicon, elemental	7,223	9,296	8,946	8,922	8,200
Silver:					
Mine output, metal content—thousand troy ounces	3,122	3,409	3,517	3,455	3,524
Metal, including alloys—do	3,226	4,155	4,952	4,173	4,688
Tin metal, including secondary—long tons	227	163	281	257	NA
Titanium metal	NA	53	52	45	NA
Tungsten metal	165	50	144	(3)	NA
Uranium oxide (U_3O_8) e	9	18	45	r 63	r 70
Zinc:					
Mine output, metal content	77,174	79,120	83,538	81,821	81,300
Clinker (70 to 75 percent zinc)	14,800	22,800	25,600	29,600	29,500
Other:					
Ores and concentrates—value, thousands	$178	$380	$226	$164	NA
Ashes and residues containing nonferrous metals	21,712	35,708	40,058	44,660	44,400
NONMETALS					
Cement, hydraulic (excluding clinker)—thousand tons	3,626	3,775	r 3,756	r 3,902	3,912
Chalk	17,200	17,686	14,932	17,390	16,800
Clays:					
Fire clay	167,473	154,474	154,460	191,221	69,400
Kaolin	44,038	41,734	r 27,286	r 29,126	27,700
Other ("Klinkerlera")	100,705	47,413	42,371	--------	42,900

See footnotes at end of table.

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Table 1.—Sweden: Production of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Diatomite	867	1,218	3,281	3,752	• 3,000
Feldspar	51,777	46,946	r 37,188	r 35,572	27,300
Fertilizer materials, manufactured:					
Nitrogenous—thousand tons	218	209	251	271	NA
Phosphatic:					
Thomas slag, gross weight—do	51	42	52	67	NA
Other—do	508	508	415	380	NA
Other, including mixed—do	666	710	675	737	NA
Graphite, all grades	39	50	28	45	NA
Lime (quicklime and hydrated lime)—thousand tons	860	878	r 837	921	•r 930
Pigments, natural mineral	--------	1,091	2,105	1,404	NA
Pyrite and pyrrhotite (including cupreous):					
Gross weight	452,400	441,300	433,600	482,500	474,400
Sulfur content	231,200	r 225,000	221,600	246,000	•r 242,000
Quartz and quartzite:					
In blocks—thousand tons	91	118	120	65	72
Other—do	937	958	1,058	1,225	• 1,250
Stone and gravel, not elsewhere specified:					
Dimension stone:					
Unworked:					
Limestone and marble—thousand tons	124	125	125	120	• 110
Granite and gneiss—do	r 156	r 150	135	143	• 150
Other, including slate—do	113	162	174	176	• 95
Worked, all types—do	237	233	215	211	197
Crushed, ground and other:					
Dolomite:					
Crude—do	106	r 142	211	263	• 320
Burnt—do	59	64	63	58	• 65
Limestone and other calcareous:					
For cement, lime, and flux—do	9,065	9,468	9,447	9,772	10,391
Other—do	351	r 456	320	417	407
Granite and gneiss—do	7,623	7,884	7,446	7,862	• 7,500
Other—do	1,059	958	1,318	900	• 850
Sulfur:					
Elemental (recovered from oil shale)	27,442	21,420	10,000	2,101	--------
Sulfuric acid (100 percent) and oleum	523,474	578,579	602,376	603,394	• 640,000
Talc and steatite	16,659	18,723	r 20,713	r 25,139	•r 23,500
MINERAL FUELS AND RELATED MATERIALS					
Coal, all grades—thousand tons	84	59	40	11	20
Coke:[3]					
Coke oven—do	375	375	500	508	• 500
Gas—do	550	530	545	499	• 500
Peat:					
For agricultural use °—do	64	84	98	r 115	100
For fuel use—do	r 41	r 25	r 25	r 25	• 25
Petroleum:					
Oil shale:					
For distillation—do	3,225	1,442	1,500	--------	--------
For fuel—do	279	294	302	307	NA
For other use—do	24	135	445	420	448
Crude oil (from shale)—do	81	r 57	r 27	--------	--------
Refinery products:[4]					
Gasoline—do	512	r 495	r 489	r 799	1,180
Kerosine, jet fuel, white spirit—do	13	9	10	109	32
Distillate fuel oil—do	r 762	r 836	r 830	r 1,481	1,989
Residual fuel oil—do	1,645	r 1,771	r 1,661	r 2,630	4,461
Liquefied petroleum gases [2]—do	40	45	45	60	1,298
Lubricants—do	65	79	80	78	
Other—do	522	582	615	740	
Total—do	3,559	3,817	3,730	5,897	8,955

• Estimate. r Revised. NA Not available.

[1] 32 to 43 percent derived from scrap.

[2] Less than ½ unit.

[3] Source: Organization for Economic Corperation and Development (OECD) (Paris). Statistics of Energy 1953–67, pp. 218–223.

[4] Source: Oil Statistics—Supply and Disposal (1964–67); and Provisional Oil Statistics, by Quarters (1968).

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TRADE

Preliminary data indicated a deficit of $390 million in mineral commodity trade, as compared with $330 million in 1967. The increased deficit was due mainly to larger imports of crude oil and nonmetals, which offset a $34 million gain in exports of iron ore. Value relationships between mineral commodity trade and total trade, and between major groups of mineral commodities, are shown by the accompanying tabulations:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	763	4,270
1967	789	4,526
1968	920	5,000
Imports:		
1966	1,195	4,571
1967	1,122	4,700
1968	1,310	5,195

Table 2.—Sweden: Mineral trade of major commodity groups

(Million dollars)

	Exports			Imports		
	1966	1967	1968	1966	1967	1968
Iron ore	200.8	183.3	217.7	2.1	0.1	1.1
Iron and steel:						
High-carbon and alloy steel [1]	218.3	205.5	226.4	13.9	13.8	16.9
Other [2]	144.5	207.6	216.7	239.9	211.8	238.2
Nonferrous metals including ores and concentrates:						
Copper	102.8	76.1	89.7	145.9	116.2	136.7
Lead	9.4	8.1	10.4	3.1	2.7	2.3
Zinc	12.1	8.0	9.1	9.8	10.7	11.5
Other	18.6	29.5	41.5	86.1	83.0	90.6
Nonmetals [3]	27.7	34.8	36.4	136.1	127.7	146.0
Fuels:						
Petroleum and products	18.3	29.3	56.7	461.3	479.6	574.6
Solid fuels	.6	.7	.9	59.2	48.6	50.0

[1] Not including high carbon or alloy steel castings, forgings, tubes, pipe blanks or bearings.
[2] Includes scrap.
[3] Includes manufactured fertilizers, cement, brick, and other commodities under Sections 27 and 56 and subsections 513, 661 and 662. Standard Industrial Trade Classification (S.I.T.C.) (Revised).

Table 3.—Sweden: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Metal, including alloys:			
Scrap	731	1,451	West Germany 874; Denmark 370.
Unwrought	596	3,887	Norway 2,862; United States 388.
Semimanufactures	13,990	18,630	Norway 6,620; Finland 5,019.
Arsenic:			
Elemental	520	NA	
Oxides and acids	16,846	17,285	United Kingdom 7,177; United States 6,596.
Copper:			
Ore and concentrate	9,215	2,588	All to Spain.
Metal, including alloys:			
Scrap	974	1,016	West Germany 591; Denmark 118.
Unwrought	34,402	37,918	United Kingdom 14,696; United States 8,152; West Germany 6,458.
Semimanufactures	36,213	27,526	Denmark 8,525; Norway 7,581; United States 7,137.

See footnotes at end of table.

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Table 3.—Sweden: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Iron and steel:			
Ore and concentrate, except roasted pyrite, thousand tons	22,287	23,057	West Germany 10,839; Belgium-Luxembourg 6,399; United Kingdom 3,788.
Roasted pyrite, do	258	299	West Germany 168; United Kingdom 135.
Metal:			
Scrap, do	19	17	West Germany 11; Norway 4.
Pig iron, including spiegeleisen,[1] do	84	139	Japan 82.
Ferroalloys, do	36	50	United States 17; United Kingdom 16.
Steel, primary forms, do	58	56	United Kingdom 19; Denmark 17.
Semimanufactures:			
Bars, rods, angles, shapes, sections, do	279		United Kingdom 115; West Germany 41.
Universals, plates and sheets, do	432	569	Denmark 88; West Germany 75; Finland 57.
Hoop and strip, do	47	44	United States 7; West Germany 5.
Rails and accessories, do	19	12	Denmark 5; United States 4.
Wire, do	48	50	United States 8; Finland 5.
Tubes, pipes and fittings, do	165	186	U.S.S.R. 40; United Kingdom 30.
Castings and forgings, rough, do	2	1	Mainly to West Europe.
Total semimanufactures, do	992	1,245	
Lead:			
Ore and concentrate	44,849	35,922	West Germany 32,096.
Metal, including alloys; unwrought	10,155	13,838	United States 6,001; Denmark 5,107.
Oxides	1,526	1,963	East Germany 791; Finland 301.
Magnesium, metal, including alloys, scrap	202	384	West Germany 240; United States 119.
Manganese ore and concentrate	23,760	4,324	Finland 3,801.
Nickel metal, including alloys:			
Scrap	371	731	West Germany 536.
Unwrought	23	454	Japan 132; Netherlands 102.
Semimanufactures	1,024	1,295	Denmark 133.
Platinum-group metals and silver:			
Waste and sweepings, value, thousands	$2,756	$2,939	West Germany $1,575; United States $663.
Metals, including alloys:			
Platinum-group, do	$179	$255	West Germany $71; Denmark $68.
Silver, do	$1,131	$3,605	United Kingdom $1,736; West Germany $597.
Silicon, elemental	9,132	7,013	West Germany 1,984; United Kingdom 1,881.
Tin metal, including alloys; unwrought, long tons	145	70	Denmark 26; Finland 26.
Tungsten ore and concentrate	24	44	United Kingdom 19; West Germany 15.
Uranium and thorium metal, including alloys, value, thousands	r $93	$28	France $26.
Zinc:			
Ore and concentrate	161,196	127,575	Belgium-Luxembourg 45,370; West Germany 28,694; Spain 30,417; Norway 19,335.
Metal, including alloys:			
Scrap	1,414	1,023	Norway 317; United Kingdom 194; Netherlands 193.
Unwrought and semimanufactures	204	454	West Germany 156; Finland 111.
Other:			
Ore and concentrate	r 666	38	Mainly to West Europe.
Ash and residues containing nonferrous metals.	68,119	77,518	United Kingdom 47,978; Norway 22,319.
Oxides, hydroxides and peroxides of metals, n.e.s.[2]	818	748	Norway 323.
Base metals, including alloys, all forms	392	428	West Germany 131; Norway 63.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc., value, thousands	$23	$42	Finland $12; Denmark $11.
Dust and powder of precious and semiprecious stone, do	$70	$175	Netherlands $158.
Grinding and polishing wheels and stones	1,878	2,030	West Germany 368; Denmark 321.
Cement	74,914	76,528	West Germany 35,778; Denmark 21,740.
Chalk	3,363	3,941	Finland 2,650; Norway 604.
Clay and clay products (including all refractory brick):			
Crude clays	4,320	1,236	West Germany 672; Finland 313.
Products:			
Refractory (including nonclay bricks)	24,396	31,187	Norway 12,083; Finland 8,594.
Nonrefractory	32,549	32,418	Norway 12,182; Denmark 7,124.

See footnotes at end of table.

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Table 3.—Sweden: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Diamond:			
Gem, not set or strung. value, thousands	$226	$237	Denmark $107; Belgium-Luxembourg $59.
Industrial do	$306	$57	West Germany $26; United Kingdom $23.
Feldspar and fluorspar	16,761	14,315	United Kingdom 3,342; Italy 3,324.
Fertilizer materials, manufactured:			
Nitrogenous	28,681	58,546	United Kingdom 33,984; India 14,000.
Phosphatic, Thomas slag	20,514	24,718	Finland 13,387; West Germany 10,913.
Other, including mixed	1,510	16,801	Poland 9,880; Turkey 6,000.
Graphite, natural	-------	157	United Kingdom 88; Yugoslavia 42.
Pyrite, gross weight	41,327	39,506	Mainly to United Kingdom.
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Granite, gneiss, sandstone etc	151,279	110,684	West Germany 58,464; Denmark 20,03
Marble and other calcareous	8,518	5,658	Denmark 4,878.
Slate	823	1,650	Norway 1,228.
Dolomite, chiefly refractory grade	3,986	4,649	Denmark 2,394; Norway 1,212.
Gravel and crushed stone	612,994	774,801	West Germany 479,523; Denmark 274,118.
Limestone	464,153	594,265	West Germany 287,355; Finland 237,438.
Quartz and quartzite	86,338	100,561	Denmark 67,313; West Germany 20,289.
Sand, excluding metal bearing	38,290	39,681	Norway 19,474; Finland 10,471.
Sulfuric acid, including oleum	57,507	32,335	West Germany 12,600; United Kingdom 9,932.
Talc and steatite	4,042	3,823	Denmark 2,367; Netherlands 1,160.
Other nonmetals, n.e.s.:			
Mineral materials	3,902	4,117	Denmark 2,717; Norway 556.
Slag dross and similar waste, not metal bearing.	88,620	68,148	West Germany 20,369; United Kingdom 11,423.
Chemical elements and inorganic acids [3]	17,072	23,803	Denmark 16,553.
Inorganic bases [4]	9,860	9,688	Norway 2,265; Denmark 1,886.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, excluding briquets	867	756	Finland 360.
Coke, including briquets	7,782	8,503	Denmark 3,021; Norway 2,772.
Hydrogen, helium and rare gases	39	425	United Kingdom 347.
Peat, including peat briquets	11,930	14,053	Denmark 7,403; Norway 2,490.
Petroleum refinery products:			
Gasoline	147,449	216,147	Norway 73,901; Denmark 72,654.
Kerosine and jet fuel	13,568	57,804	United Kingdom 40,701; Norway 16,614.
Distillate fuel oil	156,053	185,474	Norway 90,896; Denmark 72,310.
Residual fuel oil	40,345	247,573	Denmark 147,505.
Lubricants	44,973	45,606	Norway 12,635; Finland 11,878.
Other, including liquefied petroleum gases.	46,209	57,997	Denmark 30,171; Finland 15,152.
Total	448,597	810,601	
Mineral tar and other coal, petroleum, or gas derived crude chemicals.	25,595	37,496	Netherlands 18,943; United Kingdom 7,066.

r Revised. NA Not available.
[1] Includes cast iron and shot, grit, sponge, etc. of iron steel.
[2] Mostly zinc oxide.
[3] Mostly chlorine and hydrochloric acid.
[4] Mostly caustic soda, caustic potash, and artificial corundum.

Table 4.—Sweden: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	27,200	49,120	Greece 45,616.
Oxide and hydroxide [1]	47,919	86,341	Jamaica 42,351; Guyana 37,759.
Metal, including alloys:			
Scrap	239	1,091	Norway 1,009.
Unwrought	41,110	29,654	Norway 15,093; United States 5,510.
Semimanufactures	22,177	25,395	Belgium-Luxembourg 5,153; West Germany 3,086.

See footnotes at end of table.

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Table 4.—Sweden: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Chromium:			
Chromite	158,784	140,718	U.S.S.R. 103,616; Turkey 36,776.
Oxide and hydroxide	1,528	1,877	West Germany 1,309; United Kingdom 272.
Cobalt oxide and hydroxide	5	5	Belgium-Luxembourg 4.
Copper:			
Ore and concentrate	74,939	62,725	Canada 28,993; Peru 15,237.
Matte	9,260	17,751	France 14,754; Belgium-Luxembourg 2,997.
Metal, including alloys:			
Scrap	9,671	6,837	United States 2,641; France 1,865.
Unwrought	58,646	66,953	Chile 32,961; Zambia 16,722.
Semimanufactures	32,702	18,599	Finland 5,089; West Germany 3,354.
Iron and steel:			
Ore and concentrate, except roasted pyrite,	214,225	3,376	Poland 2,514.
Roasted pyrite	5,569	3,328	Finland 2,603.
Metal:			
Scrap	219,021	94,455	U.S.S.R. 27,412; Denmark 23,427.
Pig iron, including cast iron [3]	429,945	234,533	Finland 124,035; U.S.S.R. 62,856.
Ferroalloys	72,935	62,289	Norway 30,955; Republic of South Africa 9,104.
Steel, primary forms	12,110	11,171	West Germany 3,467; Republic of South Africa 3,102.
Semimanufactures:			
Bars, rods, angles, shapes, sections.	360,113	282,791	West Germany 91,275; Belgium-Luxembourg 51,508.
Universals, plates and sheets	688,760	664,386	United Kingdom 189,352; West Germany 107,573.
Hoop and strip	55,861	55,234	Belgium-Luxembourg 12,841; West Germany 12,712.
Rails and accessories	6,836	7,205	West Germany 4,151; Belgium-Luxembourg 1,799.
Wire	16,577	16,241	United Kingdom 6,410; Belgium-Luxembourg 3,331.
Tubes, pipes, and fittings	164,906	179,572	West Germany 79,753; United Kingdom 25,871.
Castings, and forgings, rough	4,323	4,053	Poland 2,867.
Total semimanufactures	1,297,376	1,209,482	
Lead:			
Oxides	1,721	1,536	United Kingdom 1,036; France 156.
Metal, including alloys:			
Unwrought	6,963	7,694	Peru 3,351; Mexico 1,523.
Semimanufactures	1,858	1,518	Belgium-Luxembourg 601; West Germany 599.
Magnesium metal, including alloys:			
Unwrought, including scrap	386	706	Norway 327; U.S.S.R. 268.
Semimanufactures	95	102	France 35; West Germany 28.
Manganese:			
Ore and concentrate	45,956	108,332	Republic of South Africa 55,545; U.S.S.R. 38,135.
Oxides	1,093	620	Japan 370.
Mercury	2,437	1,189	Spain 667; Italy 203.
Molybdenum:			
Ore and concentrate	[e] 4,000	3,469	Chile 1,153; United States 798; Netherlands 728.
Metal, including alloys, all forms	72	24	West Germany 9; Austria 3.
Nickel:			
Matte	2,313	979	All from Canada.
Metal, including alloys:			
Scrap	1,297	1,380	United States 922.
Unwrought	12,573	12,676	Norway 5,457; United Kingdom 4,888.
Semimanufactures	951	886	United Kingdom 464; West Germany 153.
Platinum-group metals and silver:			
Ore and concentrate value, thousands	$333	$286	All from Peru.
Waste and sweepings do	$425	$484	Denmark $221; United States $177.
Metals, including alloys:			
Platinum-group do	$3,109	$1,582	United Kingdom $820; West Germany $492.
Silver:			
Unwrought do	$2,959	$3,652	United Kingdom $1,684; West Germany $1,306.
Rolled or semimanufactures do	$713	$702	United Kingdom $395; West Germany $308.

See footnotes at end of table.

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Table 4.—Sweden: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Tin: Metal, including alloys:			
Unwrought, including scrap. long tons	r 760	689	United Kingdom 442; Netherlands 102.
Semimanufactures do	103	136	United Kingdom 70.
Titanium:			
Ore and concentrate	e 4,000	2,791	Australia 2,751.
Oxides	11,922	7,955	West Germany 1,768; Japan 1,597.
Tungsten:			
Ore and concentrate	1,903	914	Mainland China 491; Canada 262.
Metal, including alloys, all forms	152	57	West Germany 46.
Zinc:			
Oxide	2,385	1,903	Netherlands 915; West Germany 559.
Metals, including alloys:			
Blue powder (dust)	170	189	Norway 107; United Kingdom 80.
Unwrought	29,882	34,528	Norway 9,224; Poland 8,333; Canada 4,478.
Semimanufactures	1,436	1,367	West Germany 832.
Other:			
Ore and concentrate	93	50	All from mainland China.
Ash and residues containing nonferrous metals.	55,603	67,402	Norway 16,793; Poland 16,680.
Oxides, hydroxides, and peroxides of metals, n.e.s.	1,687	1,444	Finland 452; West Germany 353.
Metals, including alloys, all forms	2,638	2,452	Republic of South Africa 999; France 249.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	1,324	738	Greece 282; Netherlands 142.
Dust and powder value, thousands of precious and semiprecious stones.	$429	$730	United States $247; United Kingdom $236.
Grinding and polishing wheels and stones.	3,633	3,202	United Kingdom 1,441; Austria 537.
Asbestos	19,598	13,534	Canada 4,702; U.S.S.R. 4,454.
Barite and witherite	1,480	1,687	West Germany 1,605.
Boron materials:			
Crude natural borates	2,635	4,952	United States 4,950.
Oxide and acid	829	1,111	United States 568; France 489.
Cement	46,482	31,999	Denmark 19,067; Finland 10,953.
Chalk	10,190	9,541	Denmark 7,251; France 1,895.
Clay and clay products (including all refractory brick):			
Crude clays n.e.s. (bentonite, kaolin, refractory and other)	259,467	248,656	United Kingdom 208,625.
Products:			
Refractory (including nonclay bricks).	97,898	84,120	Austria 24,635; West Germany 18,837.
Nonrefractory (including nonclay bricks).	99,429	80,995	U.S.S.R. 21,318; Poland 21,010.
Cryolite and chiolite	297	1,254	All from Denmark.
Diamond:			
Gem, not set or strung. value, thousands	$1,732	$2,258	Belgium-Luxembourg $1,756.
Industrial do	$1,290	$1,044	United Kingdom $492; Netherlands $313.
Diatomite and other infusorial earths	8,775	9,460	Denmark 4,367; United States 2,556.
Fertilizer materials:			
Crude:			
Nitrogenous	26,766	22,386	All from Chile.
Phosphatic	424,838	511,832	Morocco 329,028; U.S.S.R. 95,616; United States 72,627.
Manufactured:			
Nitrogenous	470,280	392,099	Norway 348,846.
Phosphatic	18,567	232	France 230.
Potassic	170,108	215,410	West Germany 55,744; East Germany 52,154; France 33,328.
Other	73,041	27,114	Norway 20,906.
Ammonia	39,054	49,878	Norway 47,050.
Fluorspar, including feldspar	26,167	16,324	Norway 3,904; France 3,831; Mainland China 2,931.
Graphite, natural	1,461	981	West Germany 410; Norway 300.
Gypsum and plasters	361,877	364,410	France 177,771; Poland 154,604.
Lime	13,725	20,230	Denmark 15,105; West Germany 3,107.
Magnesite	15,924	7,249	Czechoslovakia 2,115; Austria 1,814.
Mica, all forms	1,272	989	Norway 490; United Kingdom 137.

See footnotes at end of table.

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Table 4.—Sweden: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Pigments, mineral:			
Natural, crude	237	228	West Germany 105.
Iron oxides, processed	6,707	6,210	West Germany 5,485.
Precious and semi-precious stone, except diamond. value, thousands	$676	$558	West Germany $319; Switzerland $108.
Pyrite	124,739	124,455	U.S.S.R. 64,277; Norway 59,995.
Salt	833,044	824,058	Netherlands 340,168; West Germany 220,875.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	27,322	23,081	Belgium-Luxembourg 5,084; Netherlands 4,741.
Caustic potash	1,274	1,348	West Germany 1,127.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Marble and other calcareous	3,807	3,411	Italy 1,779; Belgium-Luxembourg 823.
Slate	7,094	6,348	Norway 4,264; West Germany 1,931.
Other, including granite, gneiss, etc.	2,145	1,977	Norway 1,881.
Worked, all types	12,180	24,567	Portugal 19,633.
Dolomite, chiefly refractory grade	23,147	24,381	Norway 23,217.
Gravel and crushed rock	22,491	33,723	Denmark 17,289; Norway 5,783.
Limestone (except dimension)	97,586	97,022	United Kingdom 39,546; Denmark 34,876.
Quartz and quartzite	13,479	8,503	Spain 7,680.
Sand, excluding metal bearing	205,978	219,202	Denmark 107,792; Belgium-Luxembourg 99,343.
Sulfur:			
Elemental, all forms	179,038	123,877	France 62,880; United States 50,795.
Dioxide and sulfuric acid	6,651	12,064	Norway 9,580.
Talc, steatite, soapstone, pyrophyllite	18,623	18,626	Norway 10,884; Australia 2,141.
Other nonmetals, n.e.s.:			
Mineral materials	r 27,858	25,002	Norway 9,605; West Germany 6,841.
Slag dross and similar waste, not metal bearing.	23,805	15,949	France 13,110.
Oxides and hydroxides of magnesium, strontium and barium.	4,351	5,712	Norway 4,535.
Chemical elements [1]	2,337	1,062	NA.
Inorganic acids	11,789	10,076	Norway 4,664; West Germany 2,112.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,113	724	United States 512; Trinidad and Tobago 158.
Carbon black	22,596	22,919	Netherlands 9,356; United Kingdom 6,583.
Coal and briquets:			
Anthracite and bituminous coal. thousand tons	1,860	1,678	United States 781; U.S.S.R. 311.
Lignite and lignite briquets	7,259	5,926	East Germany 5,921.
Coke and semicoke thousand tons	1,286	1,018	West Germany 579; United Kingdom 124.
Hydrogen, helium and rare gases	196	166	Norway 114; Netherlands 37.
Petroleum:			
Crude and partly refined. thousand tons	3,716	6,145	Saudi Arabia 1,231; Venezuela 989; Nigeria 818.
Refinery products:			
Gasoline thousand tons	2,527	2,571	Italy 477; United Kingdom 367; Trinidad and Tobago 366.
Kerosine and jet fuel do	476	375	United Kingdom 158; Netherlands 88.
Distillate fuel oil do	7,478	6,309	United Kingdom 1,580; Netherlands 1,014; U.S.S.R. 733.
Residual fuel oil do	8,166	6,927	U.S.S.R. 3,233; United Kingdom 1,329.
Lubricants do	136	146	Netherlands 47; United Kingdom 44; United States 42.
Other, including liquefied gases. thousand tons	r 79	111	West Germany 31; Netherlands Antilles 26; United States 21.
Total refinery products	18,862	16,439	
Mineral tar and other coal-, petroleum-, or gas-derived chemicals.	35,563	30,174	Netherlands 13,748; West Germany 7,867.

• Estimate. r Revised. NA Not available.
[1] Excluding artificial corundum.
[2] Includes spiegeleisen, and sponge, powder, and shot of iron and steel.
[3] Mostly chlorine.

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COMMODITY REVIEW

METALS

Aluminum.—The 67-percent rise in output of primary aluminum in 1968 resulted from new production facilities completed at Sundsvall by Svenska Aluminum Kompaniet, a subsidiary of AB Svenska Metallverken (SM). Installation of a new potline had increased production capacity to 50,000 tons annually by yearend 1967, and another 10,000 tons of capacity was added during 1968. Further modifications were expected to raise the total capacity to 65,000 tons by 1970. Output capacity of the SM foundry at Månsbo, which produces aluminum alloys from scrap, will be raised from 7,000 tons to 14,000 tons annually in 1969 at a cost of about $650,000. At the company's Finspång works a new sheet-rolling mill was installed. Recent expansions at Finspång have included the doubling of rolling capacity for sheet to 70,000 tons annually, and the first continuous casting plant for wide strip in West Europe. SM reported that deliveries of aluminum products increased by 15 percent compared with 1967.

AB Elektrokoppar, a State-controlled producer of cable and wire, reportedly acquired a 25-percent interest in the aluminum smelter being built in Bahrain in the Persian Gulf.

Imports of alumina increased by 67 percent in 1968, to 144,000 tons while imports of bauxite declined to 41,000 tons. Imports of aluminum and alloy ingot dropped slightly, while exports increased fourfold to 16,000 tons. Trade in semimanufactures was essentially unchanged from the 1967 level.

Consumption of primary aluminum in Sweden in 1968 was approximately 62,000 tons. Total consumption was reportedly 100,000 tons in 1967, divided between various consuming sectors as follows, in percent: construction (25), electrical (18), consumer durables (15), transportation (10), packaging (8), and other (24).[3]

Copper.—The 19-percent increase in output of mine copper reported in 1968 was mainly due to initial production of ore from the Boliden company's new open-pit mine at Aitik, 15 kilometers southeast of Gällivare in Norrbotten county. Part of the increase also came from increased production at the Adak underground copper mine in Västerbotten, which is operated by Boliden under a government contract. A small share of the overall increase may have come from the Tomtebo open-pit mine in Kopparberg county, where production of copper ore was doubled in 1967 by Stora Kopparberg Bergslags AB.

The Aitik mine and concentrating plant began production in September, after a construction period of nearly 3 years and a total investment of $16.6 million. The scheduled rate of production is 2 million tons of ore annually, yielding 30,000 to 35,000 tons of flotation concentrate containing about 10,000 tons of recoverable copper. The operations are highly mechanized: Only one blast-hole drill, one power shovel, one loader and two 60-ton trucks are used in the mine; the concentrator is equipped with automatic X-ray analytic controls; and the total employment is only 100. The concentrate is smelted at Rönnskär, about 250 miles distant. Output from Aitik was expected to increase the national production of mine copper to about 25,000 tons in 1969, more than 50 percent above the 1968 level.

The Aitik ore is low-grade, averaging 0.5 percent copper and containing as little as 0.16 troy ounce of silver and 0.01 troy ounce of gold per ton. The ore mineral is chalcopyrite, associated with small quantities of pyrite. The main ore body is 2,000 meters long and 50 to 200 meters wide. Ore reserves, available by open-pit mining to a depth of 50 meters, were 30 million tons; an additional 120 million tons was available by underground mining to a depth of 300 meters. The mineralization was known to extend to a depth of 600 meters.

The Rönnskär Works of Boliden continued to account for all production of refined copper. About 40 percent of the total output in 1968 was derived from domestic and imported scrap, and 27 percent was derived from concentrates produced from mines owned by Boliden. Imports of concentrate were reduced by 25 percent while imports of copper matte were essentially unchanged, as compared with 1967 levels.

[3] Metals Week. V. 39, No. 47; Nov. 18, 1968; p. 161A.

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The Rönnskär works was shut down for 6 weeks in midyear, for repairs and modifications to permit an increase of productive capacity. Boliden was investing $3.5 million, to raise the productive capacity for blister copper to 60,000 tons annually by mid-1970. A third converter and a casting machine for billets of blister copper were being installed.

Consumption of refined copper was about 87,000 tons in 1968. Imports increased by 5,000 tons while exports declined by 10,000 tons, compared with 1967 levels.

Complex Ores of Copper, Zinc, and Other Metals.—The quantity of complex ore mined and processed by the Boliden Co. apparently continued to increase in 1968. Deliveries to company dressing plants appeared to be close to 2 million tons, compared with 1.8 million tons in 1967. A full year's production was realized at the Långdal mine, which began regular production in mid-1967 to replace the output lost when the Boliden mine was closed. Increased output was also likely at the Kristineberg and Rävliden mines, and the Kimheden mine was scheduled to begin production during the year.

In the Kristineberg district, development of the Näsliden deposit was continued and full production was to be reached by yearend 1969. At the Kristineberg concentrator, trial runs of a computer-controlled, onstream mineral analysis system were completed in October. The system provides for continuous analysis of iron, copper, lead, zinc, and arsenic in five streams. Eventually, the system will be expanded to handle 14 streams. Both the Kristineberg and Boliden concentrators were being modified, to increase product quality as well as productive capacity.

Known reserves of complex ore, in deposits owned by Boliden or leased by the company from the State, remained at a minimum of 30 million tons in 1968.

Production, by mine, of complex ore in 1966 and 1967 is shown in the accompanying tabulation, in thousand metric tons.

Except for the Falu deposit, owned by Stora Kopparberg Bergslags AB, all of the mines are owned or operated by the Boliden company. All of the mines produce copper and zinc, 11 produce lead, several produce small quantities of gold, selenium, or other metals. Pyrite is an important constituent in all but four of the deposits, and in several cases the value of recoverable sulfur is the determining factor in exploitation of the ore.

Mine	Production	
	1966	1967
Boliden	80	34
Falu	124	124
Garpenberg	200	252
Kankberg	17	64
Kaveltorp [1]	27	38
Kristineberg	195	212
Långdal	----	69
Långsele	300	333
Näsliden	14	1
Rakkejaur	97	71
Renström	163	169
Rävliden	1	16
Rävlidmyran	166	181
Rudtjebacken	250	251
Saxberget	102	104
Svärdsjö	71	74
Total	1,807	1,993

[1] Ljusnarsberg.

Source: Central Bureau of Statistics (Stockholm) Bergshantering 1967. 1969, pp. 78–80.

Iron Ore.—Production and exports of iron ore exceeded 1967 levels largely because of the price cut made to sustain the Swedish market position in face of increasing competition from producers of high-grade hematite ores and beneficiated ores in Africa and South America. Exports in 1968 increased 25 percent in tonnage to nearly 29 million tons but value increased only 19 percent to the equivalent of $217.7 million or averaging about $7.50 per ton as compared with $7.85 per ton in 1967 and $8.90 per ton in 1966. About three-fourths of all iron ore exports were destined to the European Economic Community (EEC).

Export shipments and domestic deliveries in 1968 by the two principal Swedish producers, Luossavaara-Kiirunavara AB (LKAB) and Trafikaktiebolaget Grängesberg-Oxelösund (TGO), were as follows:

Destinations	Shipments (thousand metric tons)	
	LKAB	TGO
Exports:		
West Germany	11,000	897
United Kingdom	3,800	453
Belgium-Luxembourg	7,200	698
Other	2,500	329
Total	24,500	2,377
Swedish consumers	632	1,290
Grand total	25,132	3,667

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In 1968 Swedish iron ores constituted 31 percent of iron ores imported by West Germany, 25 percent of United Kingdom iron ore imports, and 41 percent of Belgium-Luxembourg iron ore imports.

Total salable iron ore production totaled 32.4 million tons in 1968. Deliveries to domestic and foreign markets were slightly higher than production reflecting a mine stock decline of 500,000 tons. About 70 percent of total production was derived from the Kiruna operations of LKAB where production reached nearly 21 million tons of direct shipping ore and pelletizing operations yielded 1.6 million tons including the processing of concentrates from the Svappavaara and Malmberget mines.

LKAB investments totaled $5.86 million in 1968 including work on the main haulage level at Kiruna, the installation of the 350,000-ton capacity pelletizing furnace at Malmberget and the continued construction of the Allis Chalmers Grate-Kiln type pelletizing plant at Svappavaara. Completion of this 1.8-million-ton-capacity plant in 1969 will raise total LKAB pelletizing capacity to 4.5 million tons.

Exploratory drilling in two deep lying orebodies at Luossajärvi and Lappmalman was continued by LKAB and at yearend, reserves of these properties remained unreported.

Operations of TGO yielded 3.6 million tons of salable product. About 80 percent was direct shipping ore and pellets from the Grängesberg mine and the remainder was pellets and concentrates from the Stråssa mine. Cold-bonded pellet production from a pilot plant at the Stråssa mine was reported at 22,000 tons. Results obtained from this pilot plant have led to the construction of a full-scale plant with annual capacity of 1.5 million to be in production by 1970. The Grängesberg and Stråssa mines operated at full capacity to meet increased delivery commitments. A new haulage level at 515 meters was placed in partial service at Grängesberg, and a new central shaft was sunk at a location about 700 meters south of the present (Grängesberg) main shaft.

The Stora Kopparberg Bergslags AB mine at Vintjärn was operational by fall of 1968. The mine can produce sufficient ore to provide 100,000 tons of concentrate for pelletizing.

During the year Storgruvan, Norberg, Haggruvan, Stollberg, and Tuna-Hästberg mines closed. Total output from these mines was 200,000 tons.

Port facilities at Narvik were under 24-hour operation to handle increased mine output, reaching a record shipment of 21 million tons in 1968 compared with 16.8 million tons in 1967. The size of average shipments rose from 26,000 tons to 33,300 tons. Port facilities at Luleå accommodated 3.6 million tons of iron ore compared with 2.9 million tons in the previous year. Average shipment rose from 13,387 tons to 17,490 tons.

Iron and Steel.—Domestic and export market demand for iron and steel accelerated while market competition forced average prices lower than those of 1967. Total crude steel production increased by 7.0 percent; alloy and high carbon steel production, however, registered a 14-percent increase. Output of finished steel advanced 5.6 percent in 1968.

Exports of finished steel increased by 6 percent to about 1.4 million tons and value increased by 7 percent to $443 million reflecting at least in part the growing proportion of high grade steels in export (49 percent by value in 1967, 52 percent by value in 1968). In contrast, ordinary steel constituted the bulk of steel imports which totaled 1.26 million tons in 1968 or an increase of 8 percent over 1967 levels.

Apparent consumption of steel in 1968 was 3.5 million tons, almost recovering to the 1966 level from the 3.3 million tons recorded for 1967. Steel consumption by the Swedish building construction industry stagnated but a rising demand from the engineering industry more than compensated.

Pig Iron and Ferroalloys.—Nearly half of the total pig iron output was derived from TGO operations. Oxelösund accounted for 711,000 tons and Guldsmedshyttan for 56,800 tons of pig iron and 22,100 tons of ingot molds.

Uddeholms AB announced a new method of granulating pig iron eliminating the use of molds and resulting in a considerable cost savings over conventional means. Capital cost is estimated at 20 percent of conventional pig casting facilities and operating cost is about 33 percent of the conventional method. The granules have a density of 4.5 tons per cubic meter and can be transported by conveyor belt.

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Table 5.—Sweden: Production units, capacity, and output of iron and steel

(Thousand metric tons unless otherwise specified)

	1966			1967		
	Number	Capacity	Output	Number	Capacity	Output
Pig iron:						
Blast furnaces	17	2,428	2,087	16	2,487	2,248
Electric	5	168	67	5	162	46
Hot blast cupola	3	76	66	3	76	62
Total	25	2,672	2,220	24	2,725	2,356
Sponge iron furnaces	9	213	171	9	215	152
Steel:						
Bessemer converters:						
Acid	2	10	------	2	10	------
Basic (Thomas)	3	[1] 360	213	3	160	156
Open hearth furnaces:						
Acid	17	464	453	18	494	425
Basic	19	1,186	1,030	22	1,295	1,127
Electric furnaces:						
Arc	68	1,791	1,650	68	1,901	1,620
Induction	36	204	162	42	223	172
Linz-Donawitz and Kaldoconverters	8	1,746	1,407	8	1,805	1,564
Total	153	5,761	4,915	163	5,888	5,064

[1] Capacity reported by Svensk Järnstatistik, (No. 3, 1968) as 180.

Source: Central Bureau of Statistics (Stockholm). Bergshantering, 1966 and 1967. Table 4:7, p. 47.

In early 1968 an agreement was concluded between Guldsmedshyttan, Surahammars Bruk AB, and Uddeholms AB whereby Uddeholm's ingot mold foundry would cease production and the other contract parties would supply required cast steel ingot molds.

Ferroalloy production by type is shown in the following tabulation, in metric tons:

(Metric tons)

Ferroalloy	1968	1968
Ferrochromium	54,900	60,800
Ferrosilicon	30,400	38,700
Ferrosilico-chrome	56,200	62,300
Ferromanganese	39,400	34,800
Ferrosilico-manganese	25,300	30,300
Ferromolybdenum	2,200	2,700
Ferrotungsten	------	100
Ferrovanadium	400	500
Total	208,800	230,200

Steel.—Steel plant capacity increased to 5.6 million tons in 1968 as compared with 5.3 million tons in 1966; in contrast there was a drop in employment to 41,500 from 47,100 for the same period. Electric arc, Kaldo, and Linz-Donawitz (L–D) converters constituted 73 percent of overall capacity by yearend. New installations included a 120-ton electric arc furnace at Smedjebackens Valsverk raising annual capacity from 170,000 to 250,000 tons. A new L–D converter was planned for the Fagersta Bruks AB plant.

During 1968 TGO delivered peak production of 531,000 tons of plate produced at Oxelösund. Output of heavy-gage plate was 490,000 tons, a 6-percent increase over the 1967 output. The increase was at least partially attributable to a heavy-gage pipe order from the U.S.S.R. Crude steel output at Oxelösund was 710,000 tons of which more than two-thirds was Kaldo steel. An expansion of the Oxelösund Kaldo plant was approved and by yearend of 1969 will enable two Kaldo furnaces to be in operation simultaneously. TGO's facilities at Nyby Bruks AB operated at capacity with a 14-percent increase in hot-rolled plate production. Cold-rolled sheet output increased by 4.5 percent with marked growth expected in 1969 when a cold rolling mill is operational, raising Nyby Bruks AB annual cold rolling sheet capacity to 40,000 tons from the 1968 level of 17,000 tons.

Lead, Zinc, and Silver.—Mine output in 1968 included 100,400 tons of lead concentrate and 140,300 tons of zinc concentrate, both slightly below the levels of 1967. The Boliden Co. continued to account for more than 85 percent of the total mine output

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of lead, zinc, and silver as well as smelter production.

In addition to the entire output of primary lead, which is based mainly on galena concentrate from the Laisvall mine, the Boliden Co. exported 21,000 tons of lead in concentrates (mainly from mines in central Sweden) and in pelletized lead dust from the Rönnskär smelter. The company also produced an estimated 49,000 tons of zinc in concentrates and recovered another 22,000 tons in the form of clinker from the slag-fuming plant at Rönnskär. The zinc concentrates and clinker were exported, mainly to the Norwegian smelter of Det Norske Zinkkompani A/S which is owned 50 percent by Boliden.

Production, by mine, of lead and lead-zinc ores in 1966 and 1967 is shown in the following tabulation, in thousand metric tons:

Mine	Production	
	1966	1967
Laisvall	1,197	1,199
Vassbo	171	194
Ämmeberg	164	177
Stollberg	115	118
Gräns	26	40
Total	1,673	1,728

The Laisvall mine, producing only lead ore, and the Vassbo mine, producing lead ore with small amounts of zinc, were owned by Boliden and contained known ore reserves totaling at least 30 million tons in 1968. Reserve figures for the other mines, which produce both lead and zinc, were not available. The Ämmeberg mine was owned by Bolaget Vieille Montagne; the Strollberg mine, by AB Statsgruvor; and the Gräns mine, by Avesta Jernverks AB of the Axel Johnson Group.

Boliden was increasing production capacity for silver in 1968. The increased output of metal in 1968 was due mainly to larger purchases of raw materials from abroad. The company's own smelting materials accounted for 50 percent of the total output, compared with 55 percent in 1967.

Domestic consumption of refined lead increased 5 percent in 1968, to 55,700 tons, while consumption of slab zinc rose 17 percent to 35,600 tons.

NONMETALS

Cement and Other Construction Materials.—Activity in building and construction was relatively static in 1968. Aggregate sales of building materials were 3 percent lower than in 1967. Aggregate investment in building and construction rose 2 percent, compared with 5.5 percent in 1967, and a rise of 4 percent was forecast for 1969. Building investment in 1968 declined by 2 to 10 percent in the residential, commercial, and industrial sectors while increasing about 6 percent in the public sector. Residential starts and completions increased 6 percent but were expected to decline about 3 percent in 1969.

As compared with 1967 levels, production and domestic sales of cement rose less than 1 percent, while imports dropped by 25 percent and exports declined by 75 percent. Prices were unchanged from 1967 levels. Output of bricks, porous concrete, and drainage pipe declined by 5 to 10 percent, while output of tiles increased.

Production capacity for cement in 1968 was 4,665,000 tons annually. AB Skanska Cement, with six plants, accounted for 80 percent of the total capacity, while a single plant at Skovde, owned by AB Gullhögens Bruk, accounted for the remaining 20 percent. The latter company reportedly planned to increase output capacity at Skovde by 700,000 tons, to 1.7 million tons annually by yearend 1969. AB Skanska Cement also planned to raise the capacity of its Slite plant to 1.2 million tons annually.

Production and rated annual capacities of Sweden's seven plants in 1967 were as follows, in thousand metric tons:

Location	Production	Annual capacity
Limhamn	716	1,200
Skovde	850	1,000
Slite	726	750
Hällekis	583	700
Stora Vika	405	385
Köping	419	380
Degerhamn	260	250
Total	[1] 3,959	4,665

[1] Total is less than that shown in table 1. Reason not identified.

Source: Cembureau (Malmö). World Cement Directory, 1969.

Fertilizer Materials.—Although no regular production of crude phosphate is re-

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ported from Sweden, apatite concentrates are occasionally produced at Vitåfors (Malmberget) from processing of iron ore by LKAB. The most recent reported production was 5,900 tons in 1967, considerably more than the 1,100 tons previously reported in 1963. The concentrates average about 15 percent P_2O_5.

Imports of crude phosphate and nitrate increased in 1968, to 528,000 tons and 26,000 tons, respectively. Imports of manufactured fertilizer rose by 22 percent to 777,000 tons, due mainly to an increase of 100,000 tons of calcium nitrate, while exports increased by 32,000 tons.

Sales of nitrogen-phosphorus (NP) and nitrogen-phosphorus-potassium (NPK) compound fertilizers continued to grow at the expense of ordinary superphosphate and compounds of phosphorus-potassium (PK). Sales of NP and NPK fertilizers by AB Förenade Superfosfatfabriker (FS), the largest Swedish producer, increased 28 percent in 1968 (22 percent in 1967) to 185,000 tons. Total sales of fertilizer by FS were 659,000 tons, valued at $34 million, and included 58,000 tons of superphosphate. The company was concentrating production of fertilizer at Landskrona and Norrköping, having ceased production at Gäddviken (near Stockholm) in 1966. At Landskrona, FS recently completed a major expansion of the NPK plant, modernized the PK plant, and increased production capacity for phosphoric acid. Projects in 1968 included a new superphosphate plant and new crushing and handling facilities for crude phosphate.

Production of nitrogenous and compound fertilizers by AB Svenska Salpeterverken was estimated at approximately 400,000 tons in 1968.

Consumption of plant nutrients in Sweden during the 1967–68 and 1966–67 agricultural years, as reported by the British Sulphur Corporation, was 170,000 tons of nitrogen in 1967–68 (164,000 in 1966–67); 118,600 tons of potash (104,600 tons); and 130,000 tons of phosphorus pentoxide (119,000 tons).

Pyrite and Sulfur.—Despite a slight drop in overall production, output of pyrite in 1968 remained well above the 1966 level. A substantial increase in output was expected by 1972 as the Boliden Co. continued development work at the Kedträsk and Udden deposits in northern Sweden and was expanding productive capacity of the Boliden and Kristineberg concentrators. Output of pyrite from Boliden-owned mines in 1968 probably accounted for more than 90 percent of the national output, with most of the remainder produced by Stora Kopparberg Bergslags AB (SKB) at Falun.

Despite the decline in total production and a 50-percent reduction of imports compared with those of 1967, production of sulfuric acid from pyrite increased. The Reymersholm Works of Boliden, at Hälsingborg and Oskarshamm, produced 335,370 tons of sulfuric acid or 31,000 tons more than in 1967. It was not clear whether the higher output was due to increased deliveries of mine concentrates or from utilization of stocks. An additional 143,730 tons of acid was produced by Boliden from smelter gases at Rönnskär. These outputs represented 96 percent of capacity of the Reymersholm division and 82 percent of capacity at Rönnskär.

Total productive capacity for sulfuric acid was approximately 705,000 tons annually in early 1968. This capacity was based 68 percent on pyrite, 25 percent on smelter gas, 6 percent on elemental sulfur, and 1 percent on coke-oven gas. The Boliden Co. owned or controlled 85 percent of the total capacity, SKB owned about 8 percent, Elektrokemiska AB about 6 percent, and other companies 1 percent.

At Hälsingborg, construction of a new sulfuric acid plant for Boliden was continued by Lurgi G.m.b.H. The plant will have an annual productive capacity of 250,000 tons and was scheduled for completion in 1969. The new unit will raise output capacity at Hälsingborg to 550,000 tons annually. When this project is completed, Boliden will close older plants now operating at Oskarshamm (45,000 annual capacity) and at Norrköping (70,000 tons annual capacity). Pyrite is the raw material used at all of these plants. The Norrköping facility was operated by AB Förenade Superfosfatfabriker, in which Boliden owns a 52-percent interest.

At Falun, SKB was building a new sulfuric acid plant with a production capacity of 60,000 tons annually, based on pyrite. Completion was scheduled for 1970. The company will then close older production units now being operated at Falun and Skutskär.

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Two plants for production of liquid sulfur dioxide were also under construction in 1968. At Hälsingborg, Boliden was building a plant to produce 55,000 tons annually,and SKB was installing a 20,000-ton facility at Falun. Output of both plants, which will be on stream in 1970, is intended for the pulp industry. Two other sulfur dioxide plants, each with an annual capacity of 10,000 tons, have been operated since 1964 at Bohus and Essvik, respectively by Elektrokemiska AB and Svenska Cellulosa AB.

Total imports of sulfuric acid, oleum, and sulfur dioxide rose threefold to 37,000 tons in 1968 while exports doubled, to 65,000 tons. Imports of elemental sulfur increased to 149,000 tons, 20 percent more than in 1967. Consumption of sulfur in all forms was estimated at about 480,000 tons, of which about 45 percent was consumed by the pulp and paper industry and a slightly larger share was consumed in manufacturing sulfuric acid.

MINERAL FUELS

Coal and Coke.—The increase in output of coal in 1968 apparently was related to clay-mining operations in southwestern Sweden, where coal is recovered as a by-product. No coal mines have been operated since 1966 when the Nyvång mine was closed by Höganäs AB.

Imports of coal and coke increased by 3 percent and 6 percent, respectively, from 1967 levels. The United States remained the largest supplier, with 718,000 tons, but its share of the market dropped to 41 percent compared with 46 percent in 1967. Shipments from Poland and the United Kingdom also declined, as imports from the Soviet Union (432,000 tons) and West Germany (350,000 tons) continued to increase.

Output of metallurgical coke at the Oxelösund steelworks in 1968 rose to 496,000 tons, of which 22 percent was sold on the domestic market. In imports of coke, West Germany remained the major supplier with 665,000 tons and a 62-percent share of the market, compared with 579,000 tons and 57 percent in 1967.

Domestic consumption of coal and coke in 1966 and 1967 is shown by the following tabulation, in thousand metric tons:

Commodity and consuming sector	Consumption	
	1966	1967
Coal:		
Coke ovens	625	706
Gas works	690	621
Thermal powerplants	40	20
Railways	15	4
Industry	[1] 400	[1] 467
Other	120	68
Total	[r] 1,890	1,886
Coke-oven coke:		
Iron and steelmaking	[2] 1,170	[2] 1,262
Railways	10	4
Other industry	250	250
Other	350	251
Total	1,780	1,767
Gas coke:		
Gasworks	90	85
Industry	255	214
Other	200	200
Total	545	499

[r] Revised.
[1] Includes 50,000 tons consumed by iron and steel industry exclusive of coking plants.
[2] Includes approximately 500,000 tons transformed into blast furnace gas.
Source: OECD (Paris). Statistics of Energy 1953–67. 1969, pp. 220–222.

Petroleum.—All offshore and onshore exploration for oil and gas in Sweden will be conducted by Oljeprospektering AB, a Government-controlled company formed by 10 Swedish companies and company groups. The major participants were LKAB and the State Power Board with shares of 25 percent each; others included Boliden AB, Grängesberg (TGO), Allmänna Svenska Elektriska Aktiebolag (ASEA), the Oljekonsumenterna (OK) cooperative, and the Axel Johnson Group. Although foreign companies appeared to be excluded from the prospecting company, the Danish exploration group (Dansk Undergrunds Konsortium) may participate in investigations in the Öresund Strait between Sweden and Denmark.

Due to the recent expansion of refinery capacity and petrochemical facilities in western Sweden, imports of crude oil rose 47 percent in 1968 to 9 million tons, and output of petroleum products was 52 percent more than in 1967. The Koppartrans (AB Svenska Shell) and Syrhaala (Svenska BP) refineries near Göteborg accounted for most of the increase in production. With plants of AB Nynäs-Petroleum, Swedish refinery capacity totaled about 11 million tons of crude oil per year. An increase of about 8 percent in refinery output was forecast for 1969.

The OK cooperative was planning to build a refinery on the west coast, with an

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annual processing capacity of 6 million tons of crude oil, but a final decision on the timing and site of construction was not made by yearend.

The Stenungssund petrochemical complex continued to expand. Total investments by yearend were $116 million, and an additional $40 million of investment was expected by 1971. AB Svenska Esso was importing 300,000 tons of crude oil annually for its cracking plant at Stenungssund, and was building a new plant for service in 1969.

AB Svenska Shell was completing three underground storage chambers for crude oil near the Koppartrans refinery. Each chamber has a capacity of 100,000 cubic meters. The new facilities were in addition to three 60,000-cubic-meter underground chambers built at Göteborg in 1967. The company also completed a 20,000-cubic-meter underground storage unit for liquefied petroleum gas.

Imports of petroleum products rose 4.5 percent to 17.2 million tons in 1968, while exports more than doubled to 1.75 million tons. Oil products accounted for two-thirds of Sweden's energy supply in 1968 and the share was expected to increase to 70 percent by 1975.

Consumption of gasoline and fuel oils continued to increase. The number of cars, trucks, and buses rose by 230,000 units in 1968, to nearly 2.3 million. New thermoelectric plants under construction at Karlshamn, Stenungssund, and Västeras in 1968 were scheduled to add 1,180 megawatts of generating capacity to Sweden's power network by 1970. All of these plants are designed to burn fuel oil. Consumption of fuel oil for power generation in 1968 may have increased to nearly 2 million tons, compared with about 700,000 tons in 1965.

Inland consumption of all petroleum products in 1967 and 1968 was reported as follows, in thousand metric tons:

Commodity	Consumption	
	1967	1968
Gasoline	2,404	2,521
Aviation fuels	346	NA
Kerosine	229	213
Distillate fuel oil	15,222	7,606
Residual fuel oil		10,248
Liquefied petroleum gas	70	
Refinery fuel	380	1,484
Other	771	
Total	r 19,422	22,072

r Revised. NA Not available.

Source: OECD (Paris). Statistics of Energy 1953–1967. 1969, p. 233; Provisional Oil Statistics, 4th Quarter 1968. 1969, pp. 15–21.

Uranium and Nuclear Energy.—Production of uranium oxide from low-grade deposits in shale was continued by AB Atomenergi at Ranstad. The mine and plant were operated at approximately 40 percent of productive capacity. The Ranstad operation was expected to continue for 3 more years, to test the feasibility of reducing production costs to more competitive levels. Production cost at Ranstad in 1968 was reportedly about $14 per pound of U_3O_8. The Government was faced with the alternatives of exploiting the large, but low-grade, uranium resources in the Billingen shale at a relatively high cost, or stopping production at Ranstad and importing the uranium required for the power reactors now under construction or planned. Uranium requirements were expected to be 1,700 tons annually by 1980.

There were reports of uranium discoveries in southwest Sweden, north of Göteborg and west of Lake Vänern, and in Norrbotten county, but no details were available.

The small Ågesta nuclear powerplant supplied about 19 million kilowatt-hours of electricity in 1968, and the equivalent of 112 million kilowatt-hours in the form of district heating to the Stockholm suburb of Farsta. The reactor was shut down from March to October, for repairs and refueling. Eighty miles southwest of Stockholm, the Marviken powerplant was nearly completed. Test running of the reactor systems began in October. The reactor was scheduled to go critical in late 1969 and full power production was expected in 1970. Construction of the Oskarshamn (Simpevarp) powerplant, 150 miles south of Stockholm, was also continued. New projects were begun, for a second plant at Oskarshamn and for Ringhals I and II powerplants south of Göteborg. The types of reactors, with net output in megawatts of electricity (MWe), installed or planned at these localities are shown in the following tabulation:

Powerplant	Reactor type	MWe	Date critical
Ågesta	PHWR	9	1963
Marviken	BHWR	[1] 132	1969
Oskarshamn I	BWR	400	1970
Oskarshamn II	BWR	600	1974
Ringhals I	BWR	760	1973
Ringhals II	PWR	800	1974

[1] Increasable to 196 MWe with superheat system.

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Thirty-two tons of zircaloy-clad uranium dioxide fuel elements, for the core of the Marviken reactor, were produced by year-end 1968 at the AB-Atomenergi plant in Stockholm. The company has produced about 100 tons of uranium and UO_2 fuel elements since 1953. The company's commercial division, and the nuclear division of Allmänna Svenska Elektriska Aktiebolaget (ASEA), were merged to form a new company, ASEA/ATOM. The new firm, owned jointly by the Government and private interests, was to take over operation of AB Atomenergi's fuel fabrication facilities at the beginning of 1969. In a related development, a pilot plant for production of plutonium-enriched fuel was under construction at Studsvik and was scheduled for completion in 1969.

Electric Power.—Production of electric power rose 4.5 percent in 1968, to 56.2 billion kilowatt-hours (kwhr). While hydroelectric plants accounted for 87 percent, thermoelectric plants accounted for the entire increase in total output and produced nearly 7.5 billion kwhr compared to the previous high of 5.1 billion kwhr produced in 1966. Most of these plants burn fuel oil.

Consumption of electricity increased 9 percent, to 58 billion kwhr. Industry accounted for 51 percent of total consumption. Shares of total consumption, by industrial sector (in percent), were as follows: mining (2.3), primary metals (11.3), nonmetallic mineral manufacturing (2.1), and chemicals including coal and petroleum products (7.0).

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The Mineral Industry of Taiwan

By R. A. Pense [1]

Lacking extensive mineral resources, Taiwan's mineral industry has concentrated increasingly on processing imported raw materials to meet national needs. Refining crude petroleum, melting steel scrap, and processing bauxite and phosphate rock all apparently reached new highs in 1968. The cement industry, the only sector that uses largely domestic materials, also broke records. Together with the chemical fertilizer industry, these processing industries had an added value substantially exceeding the production value of the extractive sector. Coal continued to account for three-quarters of mine output value, although production stagnated and economically minable reserves dwindled.

The fourth 4-year plan (1965–68) was successfully completed in 1968 with a gross national product (GNP) preliminarily estimated at $3,809 million [2] (in 1964 prices). This represented a 10.3 percent increase over 1967 and brought the average annual rate of expansion under the plan to about 10.5 percent, appreciably above the projected rate of 7 percent per annum. The extractive sector of the mineral industry alone accounted for 1.6 percent of 1968 GNP.

Mining and mineral-related manufacturing contributed production values of $89 million and $361 million, respectively, to the economy in 1968. The former was approximately 2 percent below and the latter 18 percent above 1967 levels. Production indices of the major elements of mining and mineral processing follow (1961=100):

Economic sector	1967	1968
Coal mining	117.5	116.0
Crude petroleum and natural gas production	1,424.9	1,931.0
Metal mining	107.3	97.2
Miscellaneous nonmetallic mining and quarrying	164.2	184.5
Salt evaporation	120.8	68.9
Basic metals	224.0	236.3
Nonmetallic products	212.5	242.9
Petroleum and coal products	261.9	325.2

• Estimated.

In comparison with other sectors of the economy, the mineral industry performed somewhat poorly under the fourth 4-year plan. A much discussed integrated iron and steel plant was not started. The total amount of steel products manufactured during 1968 probably approximated the 536,000 tons set for that date, although it was considerably short of demand. Within the fertilizer industry the important targets for urea (265,000 tons) and ammonium sulfate (455,000 tons) were only 77 percent and 84 percent met, respectively. Of the two major facilities to be erected for primary petrochemical production, the naphtha cracking unit was completed and aromatics extraction unit was under construction; however, apparently only one of the projected intermediate products plants was finished. Aluminum ingot and sheet capacities were expanded beyond their respective targets of 20,000 and 18,000 tons, but power shortages kept them operating at reduced levels. Electrolytic copper output only reached about one-half the 5,100-ton forecast. Pyrite production reached about two-thirds of the 58,000 tons planned. Production of cement, on the other hand, exceeded the 3.6-million-ton goal by 11 percent.

The primary fuels sector experienced the greatest variances from the plan. Coal production leveled off at 5 million tons annually, far short of the 6 million tons originally set. A second natural gasoline plant was under construction as planned, but 1968 output of natural gas itself was only about 70 percent of the 35 million cubic feet targeted. Crude petroleum slightly exceeded the production goal of 320,000 barrels, while output of petroleum products was more than twice the 10 million barrels projected. A 50,000-barrel-per-day

[1] Research specialist, Division of International Activities.

[2] Where necessary, values have been converted from New Taiwan dollars (NT$) to U.S. dollars at the rate of NT$40.10=US$1.

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topping unit and a 5,000-barrel-per-day hydrodesulfurization unit were completed as planned, but a 10,000-barrel-per-day hydrocracking unit was not.

As now outlined, the fifth 4-year plan (1969–72) will have as its overall objective a 7-percent-per-annum GNP growth rate. Total plan expenditure is expected to be $4,500 million: Domestic capital formation will account for $3,800 million of this total, international loans $500 million, and private foreign investment $200 million. Within the private sector of the economy, the principal mineral industry project was again expected to be an integrated iron and steel plant. This plant would provide the basis for the development of metal products, light machinery, electrical equipment, and shipbuilding industries. In the public sector, the two existing petrochemical complexes were to be expanded to provide the materials necessary for the growth of chemical fertilizers, synthetic fiber, and rubber and plastics industries. Major infrastructure schemes include expanding present electric power generating capacity (1.9 million kilowatts at yearend 1968) to 3.0 million kilowatts, increasing port cargo handling capacity to 24 million tons annually, constructing the northern half of a north-south expressway, and building a large multipurpose water reservoir.

Foreign investment rose sharply again in 1968 to total $104 million for the year. Continued improvement in the overall investment climate and the institution of new, simplified, rapid application procedures during 1968 were allegedly responsible for the 65-percent rise over 1967. Carried to completion, the 338 investment projects approved by the Government under the Statute for Investment by Foreign Nationals and Overseas Chinese reportedly could employ as many as 51,000 persons. This could eventually result in foreign exchange earnings of $260 million annually.

Near yearend 1968, the recently formed Asian Development Bank agreed to loan the Government-owned Chinese Petroleum Corp. $10.2 million to partially finance a plant to manufacture ethylene dichloride, a petrochemical intermediate. Part of the output is to be exported to South Korea, in accordance with decisions made at the fourth annual economic cooperation meeting of the Taiwanese and South Korean Governments in July to coordinate as much as possible their emerging petrochemical industries.

In August the Mining Research and Service Organization, an agency under the Ministry of Economic Affairs, inaugurated a Mining Research Institute. The new Institute was reportedly established to expedite mineral resource exploitation.

PRODUCTION

The mineral industry (excluding the chemical fertilizer sector) contributed to the economy $450 million in 1968. The 13-percent rise over the previous year's value was the result of increased production of mineral fuels, up 24 percent to $233 million; and nonmetals, up 15 percent to $155 million. Output of metals dropped 16 percent to $62 million.

Among mineral fuels quantitative output from petroleum refining, the most important of the fuel-producing sectors, climbed almost 30 percent. This was principally in response to greater indigenous demand for residual fuel oil. While production of the significant coal sector did not increase, the relatively minor crude oil and natural gas producing sectors apparently posted 71 percent and 34 percent rises, respectively.

The most important factor in the increase in nonmetallics value was probably the expansion of cement production: Domestic demand was apparently sufficiently strong to overcome an appreciable drop in the previous high level of exports and to spur an 11-percent jump in output.

The fall in metals value was the result of a production decline in late 1968 from the key iron and steel rolling sector, which was allegedly hit hard by accelerated Japanese product imports.

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Table 1.—Taiwan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Alumina •	43,000	42,000	42,000	42,000	42,000
Ingots	19,372	18,912	17,217	15,440	20,020
Sheets	8,104	9,237	9,422	10,398	9,402
Copper:					
Ore, 0.44 to 0.70 percent Cu	119,973	114,191	139,290	85,014	NA
Concentrate, 12.0 to 16.3 percent Cu	9,291	10,313	9,302	10,658	• 10,700
Mine	1,738	• 1,900	• 2,500	• 2,300	• 2,300
Electrolytic	1,887	2,189	2,411	3,001	2,542
Gold:					
Gold-copper ore—thousand tons	200	213	220	263	NA
Gold ore	1,483	1,581	2,348	2,941	NA
Refined gold—troy ounces	r 19,376	r 35,270	r 45,867	r 35,563	20,994
Iron and steel:					
Iron ore:					
Limonite, 30 to 40 percent Fe	1,021	5,633	3,444	2,720	NA
Magnetite, 50 percent Fe	5,877	8,852	10,121	9,879	NA
Pig iron—thousand tons	62	72	71	85	76
Steel ingots and castings—do	300	440	300	250	• 250
Rolled steel—do	260	385	320	430	• 400
Silver—thousand troy ounces	r 67	r 96	r 87	r 127	77
NONMETALS					
Asbestos	477	801	654	572	• 1,200
Cement—thousand tons	2,355	2,444	3,112	r 3,487	3,993
Clays:					
Ceramic and pottery—do	40	• 47	55	57	NA
Paper filler—do	3	• 4	4	4	NA
Used in cement—do	471	• 550	620	684	NA
Brick and tile—do	500	• 713	820	830	NA
Total—do	1,014	1,314	1,499	1,525	NA
Dolomite, 19 percent MgO—do	33	51	52	57	79
Gypsum, 75 to 96 percent gypsum—do	17	28	8	r 16	6
Lime—do	91	103	107	93	130
Limestone—do	3,717	4,076	5,167	5,727	NA
Pyrites, 25 to 45 percent S—do	46	39	42	39	39
Salt, sea—do	602	560	411	517	311
Sand, glass—do	94	115	125	126	NA
Sulfur:					
Refined, 97 to 99 percent S	6,492	4,495	4,595	3,425	NA
Contained in pyrites	17,081	16,000	16,900	• 14,920	NA
Recovered from refinery gases, 99 percent S	2,825	2,386	2,375	3,065	NA
Talc, mostly soapstone grade—thousand tons	17	15	29	41	29
MINERAL FUELS					
Carbon black	197	637	460	495	NA
Coal, subbituminous to bituminous—thousand tons	5,028	5,054	5,015	5,078	5,014
Coke:					
Coke oven and beehive (including semi-coke)—thousand tons	203	211	r 205	• 207	• 206
Gas plants—do	42	46	r 52	• 45	• 50
Total—do	245	257	257	252	256
Natural gas—million cubic feet	6,822	11,557	15,507	18,616	24,877
Petroleum:					
Crude—thousand 42-gallon barrels	61	131	226	246	421
Refinery products:					
Gasoline—do	2,170	2,244	2,739	2,889	3,031
Kerosine—do	246	189	218	162	62
Jet fuel—do	1,390	1,673	2,072	r 2,208	• 2,000
Distillate fuel oil—do	1,724	2,166	2,354	3,039	3,337
Residual fuel oil—do	3,937	5,853	7,414	7,092	11,258
Asphalt—do	245	325	483	626	747
Lubricant oils and feedstocks—do	-------	97	540	603	681

• Estimate. r Revised. NA Not available.

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TRADE

Preliminary data for 1968 commodity trade indicate new highs for both imports, up 12 percent to $903.3 million, and exports, up 25 percent to $800.2 million. Total minerals trade, however, decreased, principally owing to decreased shipments to South Vietnam. Increasingly unsettled economic conditions, coupled with further cutbacks in the U.S. Commercial Import Program under which U.S. funds were used to finance commodity imports, forced South Vietnam to reduce its high imports of Taiwanese iron and steel products, cement, and manufactured fertilizers. Total mineral exports fell about 19 percent and constituted only about 6 percent of all 1968 product exports, a decrease from the 9 percent contributed in 1967 and 10 percent in 1966.

Mineral imports in 1968 showed a modest 4 percent increase over the previous year. However, their portion of all commodity imports dropped to approximately 19 percent, compared with 20 percent in 1967 and 24 percent in 1966. Increased 1968 imports of crude petroleum and petroleum products, needed to meet growing internal demand, were partially offset by reduced amounts of imported iron and steel products. A significant portion of these were unfinished products processed further before export, mainly to South Vietnam. Imports of iron and steel scrap continued to decline as the indigenous steel industry turned increasingly towards ship dismantling as a source of scrap supply. The expanding fertilizer industry further cut down the amount of foreign exchange needed to purchase imported manufactured fertilizers. Table 2 shows this overall trend and the changes in the major components of Taiwanese mineral trade in 1966–68.

Table 2.—Taiwan: Value of export and import commodities

(Million dollars)

	1966	1967	1968 p
EXPORTS			
Mineral commodities:			
Copper ore	2.0	1.7	1.8
Iron and steel products	15.8	17.7	12.0
Other metals and alloys (mostly aluminum)	4.7	3.9	5.4
Cement	18.7	18.4	18.9
Manufactured fertilizers	3.4	6.7	3.9
Petroleum products (mostly lubricant feedstocks)	3.4	5.0	5.7
Other	5.2	4.7	4.5
Total [1]	53.2	58.1	47.2
Other commodities	483.3	583.3	753.0
Total exports	536.5	641.4	800.2
IMPORTS			
Mineral commodities:			
Iron and steel scrap	13.0	10.0	9.3
Iron and steel products	52.6	63.4	58.1
Other metals and alloys	12.8	16.1	16.6
Sulfur	4.1	10.8	8.6
Manufactured fertilizers	5.0	3.4	2.9
Petroleum and products (mostly crude oil)	47.1	• 45.0	58.1
Other	15.4	• 13.9	15.4
Total [1]	150.0	• 162.6	169.0
Other commodities	474.2	• 646.0	734.3
Total imports	624.2	808.6	903.3

• Estimate. p Preliminary.
[1] Total of listed figures only.

In December the government announced the imposition of import restrictions on heavy and medium steelplates. Increasing imports of these items from Japan had allegedly been causing distress in the rolling sector of the Taiwanese steel industry.

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Table 3.—Taiwan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum and alloys, all forms	6,671	4,552	South Vietnam 2,702.
Copper, ore and concentrate	15,407	15,669	All to Japan.
Iron and steel:			
Pig iron	9,705	4,235	South Vietnam 4,155.
Ferroalloys	2,802	1,339	South Vietnam 554; Japan 265.
Semimanufactures—thousand tons	115	136	South Vietnam 77; Thailand 26.
NONMETALS			
Cement:			
Portland—thousand tons	1,193	1,122	South Vietnam 854; Thailand 151.
White—do	15	8	South Vietnam 4; Philippines 3.
Fertilizers, manufactured:			
Nitrogenous—do	31	68	South Vietnam 36; India 17.
Other, n.e.s.—do	1	16	South Vietnam 14.
Salt—do	130	17	Ryukyu 5; Malaysia 5; Hong Kong 4.
MINERAL FUELS			
Coke	15,476	8,130	Philippines 4,830; Singapore 1,555.
Petroleum refinery products:			
Gasoline—thousand 42-gallon barrels	37	87	All to Thailand.
Lubricants and feedstocks—do	171	349	Japan 198; Hong Kong 97.
Pitch and asphalt—do	110	168	South Vietnam 81; Singapore 31.
Other—do	(1)	46	Thailand 13; Philippines 11.

[1] Less than ½ unit.

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1966 (pub. 1967), 507 pp.; 1967 (pub. 1968), 863 pp.

Table 4.—Taiwan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum and alloys:			
Bauxite	90,348	103,347	Malaysia 102,356.
Scrap	1,734	3,854	Hong Kong 1,243.
Unwrought and semimanufactures	1,740	4,410	United States 2,849; Japan 1,475.
Copper and alloys, all forms	4,881	3,618	Japan 3,313.
Gold bullion—troy ounces	235,567	345,731	United Kingdom 328,831.
Iron and steel:			
Ore and concentrate—thousand tons	107	68	Nearly all from Malaysia.
Scrap—do	r 283	218	United States 93; Hong Kong 40.
Pig iron	2,664	3,900	All from Japan.
Ferroalloys	14,590	22,251	Japan 18,778; United States 2,456.
Ingots and other primary forms	14,527	49,598	Australia 40,422; West Germany 6,164.
Semimanufactures—thousand tons	318	374	Japan 295; Australia 28.
Lead and alloys, all forms	3,736	5,454	Australia 3,656; United States 1,126.
Manganese dioxide	2,226	1,820	Japan 1,670.
Mercury—76-pound flasks	928	943	Mexico 570; Peru 185.
Nickel and alloys, all forms	138	152	Canada 89.
Tin and alloys, all forms—long tons	387	328	Malaysia 309.
Titanium dioxide	2,327	2,738	Japan 1,456; Australia 753.
Zinc and alloys, all forms	7,093	10,912	Canada 3,737; Australia 3,562; Japan 3,451.
NONMETALS			
Abrasives	1,285	1,427	Japan 1,179.
Asbestos	2,366	2,682	Canada 1,121; Republic of South Africa 1,016.
Fertilizers:			
Crude: Phosphatic—thousand tons	r • 159	• 155	Morocco 110.
Manufactured:			
Nitrogenous—do	68	172	Nearly all from Japan.
Potassic—do	82	95	Canada 32; United States 30.
Graphite	2,794	2,002	South Korea 1,948.
Gypsum—thousand tons	r 75	62	Australia 40; Cyprus 10.
Sulfur—do	69	166	United States 69; Mexico 48; Canada 48.
MINERAL FUELS			
Coal—do	9	12	Australia 9; Republic of South Africa 3.
Petroleum:			
Crude—thousand 42-gallon barrels	19,202	18,250	Mainly from Iraq and Kuwait.
Refinery products:			
Fuel oil—do	1,241	858	Mainly from Kuwait.
Lubricants—do	190	202	Japan 129; United States 64.
Other—do	130	143	United States 89.

• Estimate. r Revised.

Source: Chinese Maritime Customs, Statistical Department, Inspectorate General of Customs (Taipei, Taiwan). The Trade of China 1966 (pub. 1967), 507 pp.; 1967 (pub. 1968), 863 pp.

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COMMODITY REVIEW

METALS

Aluminum.—In October the Taiwan Aluminium Corp. (TALCO), the country's Government-owned and only fully integrated aluminum concern, brought hot and cold rolling units into operation. The hot mill, consisting primarily of a two-high reversing stand, produces plates up to 1,900 millimeters wide and strip up to 1,320 millimeters wide. The cold-rolling unit, comprising a four-high reversing stand and a two-high nonreversing stand, makes strip as wide as 1,270 millimeters. During the year, TALCO also contracted with Kawasaki Dockyard Co., Ltd., of Japan for the installation of a new $611,000 alumina unit with a 140-ton-per-day output capacity. Using a cyclone-type, suspension preheating unit and a shaft drier instead of the conventional rotary kiln, the facility was intended to increase TALCO's present 42,000-ton-per-year alumina capacity. Bauxite from Malaysia was the principal raw material for operations.

Copper.—Mines in the Chinkuashih area of northern Taiwan again produced a relatively substantial amount of copper ore. A large part of this was concentrated and shipped to Japan (16,452 tons in 1968). The remainder was electrolytically refined by about six indigenous companies; the largest of these by far was the Taiwan Metal Mining Corp. The Taiwan Power Company and local electric wire manufacturers were the major consumers of this metal and of the 1,600 tons recovered from scrap and the 4,979 tons of imported copper.

Iron and Steel.—Plans for the establishment of a 1-million-ton-per-year integrated steel plant were postponed for at least 2 years in 1968. Sufficient capital could not be obtained to begin even the first (rolling-mill) stage of the three-phase, 10-year plant construction scheme proposed by a consortium of three Japanese builders. Rising costs and insufficient indigenous steel demand were also cited as factors in the delay of the project, although it will probably be included in the final version of the new 4-year plan.

Meanwhile, two-thirds of Taiwan's demand for steel continued to be met principally by about 20 small electric-arc-furnace operations, using mostly scrap derived from ship-dismantling yards, and approximately 50 rolling mills. The largest single producer was the Government-owned Chung Hsing Steel Mill (formerly Tang Eng Iron Works) which during the year moved its activities from central to suburban seaside Kaohsiung. This completed a short-term, three-stage plant modernization and expansion program partially financed by Japanese loans with technical assistance provided by Yawata Iron and Steel Co., Ltd., of Japan. Steel-producing facilities here include a new 30-ton Heroult-type electric furnace and two older 10-ton electric furnaces. Newly installed, Japanese rolling equipment includes a wire rodmill (capacity of 5,000 tons monthly of products), a 43-centimeter-wide bar and angle mill (capacity of 4,000 tons monthly), and a 66-centimeter-wide structural shape mill (capacity of 8,600 tons monthly). Chung Hsing was expected to initially produce about 144,000 tons per year of steel and steel products at its new works and to employ about 2,800 workers.

NONMETALS

Cement.—Eight of the approximately 12 cement manufacturers reached a 3-year agreement in early 1968 to regulate production and exports. One of the problems allegedly solved by the accord was the recurrent shortages of cement experienced in northern Taiwan, the principal consuming area. Producers, located mostly in the southern part of the island, had been reluctant to ship cement to the north when foreign markets were available. A joint exporting company—the China Cement Trading Corp.—was formed to handle exports on a quota basis. The industry's own 1968 output target of 4.4 million tons—2.8 million tons for domestic consumption and 1.6 million tons for export—was not met, although the original government-set target of 3.6 million tons was easily exceeded.

Pyrites and Sulfur.—Production continued to dwindle from Taiwan's limited pyrite reserves, estimated at about 2.2 million tons at the beginning of the year. The largest part of output was either "black ore" pyrite from the Chihsingshan area or flotation concentrate from the Chinkuashih area. Most of the pyrite, as

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well as the bulk of the refined sulfur and sulfur recovered from gases at the Kaohsiung refinery of the Chinese Petroleum Corp. (CPC), were consumed by manufacturers of chemical fertilizers. The largest portion of sulfur needs, however, were imported (65,905 tons in 1968).

MINERAL FUELS

Coal.—Output continued to stagnate at the 5-million-ton level. It fell short of the revised 5.2-million-ton target for the year, and appeared unlikely to make any significant future contribution towards meeting Taiwan's growing energy needs.

Natural Gas.—Development of the country's 960 billion cubic feet of proven gas reserves continued in 1968. The Toufen industrial park in the northwestern part of the island, selected as a site for Taiwan's northern petrochemical complex, was being expanded to 116 hectares to accommodate new natural gas consuming installations. A natural gas processing plant, capable of treating slightly over 100 million cubic feet daily of natural gas and extracting up to 300,000 barrels annually of gasoline, as well as substantial amounts of liquefied petroleum gas, was under construction at the Tiehchenshan field in the same vicinity. This plant is in addition to a similar but much smaller unit now functioning at the nearby Chinshu field. Taiwan's second nitrogenous fertilizer plant came on stream near midyear at Hsinchu in northwestern Taiwan. Reported production capacity was 150,000 tons annually of ammonia, 100,000 tons of urea, and 140,000 tons of ammonium sulfate. The Chang Chun Petrochemical Co., Ltd., ordered its second methanol-producing plant (130-ton-per-day capacity) from Power-Gas Corp., Ltd., of United Kingdom.

Petroleum.—Although production of domestic crude oil increased 71 percent in 1968, the new output was apparently still less than the yearly increase in domestic consumption; total production remained insignificant compared with crude oil imports. To increase reserves, the Government-owned CPC supplemented its active onshore drilling program by adding two new drilling rigs to its previous eight and began offshore investigations. Particular emphasis was placed on prospecting off the northwestern shore of the island where oil-bearing formations of the Tiehchenshan field were believed to extend. During midyear a joint Japanese-Taiwanese seismic refraction survey was completed, for which the Japanese contributed one-third of the expense in the form of technical assistance and equipment. This was to be followed by a program to prepare seismic and air gun refraction profiles; U.S. and West German technical assistance was to be obtained for this second-phase work. The entire project is being sponsored and assisted by the Economic Commission for Asia and the Far East of the United Nations.

Civilian demand in 1968 for products, including bunkers, was estimated in late 1967 to include 13,080,000 barrels of residual fuel oil, 2,720,000 barrels of distillate fuel oil, 2,250,000 barrels of gasoline, and 1,120,000 barrels of other products. Of the 19,170,000-barrel total, industry was expected to consume 61 percent (mostly residual fuel oil); transportation, 26 percent (largely distillate fuel oil and gasoline); fishing fleets, 10 percent; and residential and commercial heating and lighting, the remaining 3 percent.

With the addition near midyear of 50,000 barrels-per-day of new capacity, CPC boosted crude oil processing potential at the country's sole refinery at Kaohsiung to about 110,000 barrels daily. Other expansion schemes underway or planned included the raising to 15,000 barrels daily of both catalytic reforming capacity (about 8,000 barrels daily in 1968) and hydrodesulfurization capacity (approximately 9,500 barrels). Despite these steps towards self-sufficiency in petroleum processing, a deficit continued to exist in residual fuel oil owing to rising power generation needs. China Gulf Oil Corp.'s 1,500-barrel-per-day lubricating oil plant produced sufficient products to meet lubricant requirements and to export a substantial share of its output. Some consumers, however, still preferred to import lubricants for price and quality reasons.

Taiwan's southern (petroleum-based) petrochemical complex, located near the Kaohsiung refinery, was expanding. CPC was planning to build a 26,400-ton-per-year plant producing ethylene dichloride, an important petrochemical intermediate. Using ethylene gas piped from CPC's nearby naphtha cracking unit as raw material, the installation would join the present polyethylene manufacturing plant of Taiwan Polymers Corp. in the complex as a producer of second-stage petrochemicals.

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The Mineral Industry of Thailand

By A. F. Grube [1]

Thailand's economy in 1968 resumed its rapid expansion after a slight setback caused by drought of 1967. Preliminary estimates for 1968 indicate more than an 8-percent growth in the gross national product at 1962 prices.

During 1968 the Thailand Board of Investment issued certificates for 113 new enterprises and for the expansion of five operating enterprises. These new businesses, when and if they proceed with their investments, will involve an outlay of about $160 million in a variety of projects, including petroleum exploration, manufacture of tires and textiles, and food processing. United States investors committed themselves to eleven jointly owned and five wholly United States-owned ventures totaling $48 million, of which U.S. investors will supply $36 million. Oil exploration will account for $19.5 million of this total.

During the year a proposed petroleum income taxation bill was submitted by the Ministry of National Development to the Council of Ministers. The more important provisions state that profits shall be split on a 50–50 basis between the Government and the company, and that the royalty on oil or gas produced shall be 12.5 percent.

In 1968 some 50-odd companies, including nine international companies, submitted applications for offshore tin mining concessions. Three additional unnamed companies were reported to have been granted 34 offshore tin concessions measuring 14 square kilometers each. All the areas granted were in the bays of Phuket and Takuapa.

Consumption of electric power was 2,540 million kilowatt hours in 1968, an increase of nearly 30 percent over the 1967 level. During the year the Yanhee Electricity Authority was constructing a 200,000 kilowatt thermal power plant in Thon Buri, and planned to add another plant capable of using nuclear energy. The Authority also added two new generators at the Yanhee dam capable of adding 150,000 kilowatts per year to the electrical output. The Provincial Electricity Authority obtained a loan of $5 million from West Germany in 1968 for the construction of transmission lines linking various districts of 14 provinces. In August the Thailand Senate passed a bill merging the Yanhee Electricity Authority, the Lignite Authority, and the Northeast Electricity Authority into a single Electricity Authority to reduce production costs.

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[1] Industry economist, Division of International Activities.

PRODUCTION

Despite a decline in world tin prices and inauguration of tin export controls in September 1968, Thailand's tin production increased sufficiently to maintain the country's position as the free world's third largest producer. Tin production continued to account for over 50 percent by value of total Thailand mineral production.

Iron ore barely maintained its position as Thailand's second most valuable mineral. Production of fluorspar, which continued its rapid advance during 1968, nearly equaled the value of iron ore. Other minerals which registered substantial im-

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provement during the year included gypsum and cement. Output of petroleum products also increased, primarily as a result of the increased output of the Thai Oil Refining Company, Ltd. refinery at Sriraja.

Table 1.—Thailand: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Antimony:					
Ore	2,819	2,502	r 2,394	2,280	421
Mine output, metal content •	1,269	1,130	1,068	1,026	2
Metal	258	173	213	129	380
Chromite	--------	--------	--------	210	--------
Columbite	--------	--------	--------	46	40
Iron and steel:					
Iron ore 55 percent iron thousand tons	191	750	692	549	500
Pig iron do	5	5	2	6	• 40
Steel ingots and castings do	4	7	5	3	NA
Lead, mine	3,656	5,581	6,371	3,477	2,720
Manganese:					
Battery grade, 75 percent manganese dioxide	3,113	4,069	7,459	9,145	5,855
Metallurgical grade, 46–50 percent manganese dioxide	7,742	29,259	63,093	69,420	35,213
Chemical grade, 75 percent or more manganese dioxide	200	100	50	--------	--------
Tin:					
Tin-in-concentrate long tons	15,597	19,047	22,565	r 22,490	23,678
Metal do	r 38	r 5,548	r 17,062	r 26,634	24,662
Tungsten concentrate, 65 percent tungsten trioxide	397	512	r 520	r 839	935
Zinc, mine (in lead zinc ore) •	1,380	2,110	2,400	--------	--------
Zirconium	--------	--------	--------	1,530	3,220
NONMETALS					
Barite	--------	NA	NA	224	• 225
Cement thousand tons	1,060	1,249	1,488	1,737	2,365
Fluorspar, 80 to 85 percent calcium fluoride	63,538	51,829	48,027	133,152	245,097
Gypsum	41,900	11,240	39,629	61,696	128,094
Marl (used for cement) thousand tons	1,058	1,105	1,162	1,214	1,624
Salt, sea 85 to 90 percent sodium chloride thousand tons •	190	188	200	110	150
Talc and related materials: Pyrophyllite	--------	--------	--------	13	3,363
MINERAL FUELS					
Coal, lignite thousand tons •	104	125	171	335	305
Petroleum:					
Crude thousand 42-gallon barrels	r 18	r 14	r 14	r 14	26
Refinery products:[1]					
Gasoline and naphthas do	NA	NA	3,785	3,214	3,357
Kerosine do	NA	NA	111	562	992
Jet fuel do	NA	NA	1,677	1,364	1,197
Distillate fuel oil do	NA	NA	• 4,707	4,987	5,405
Residual fuel oil do	NA	NA	4,242	3,910	5,127
Lubricating oil do	NA	NA	15	47	68
Asphalt do	NA	NA	440	767	408
Liquefied petroleum gas do	NA	NA	65	147	756
Other do	NA	NA	--------	--------	--------
Total do	2,961	11,337	15,042	14,998	17,305

• Estimate. r Revised. NA Not available.
[1] Thailand's first commercial refinery went on stream in late 1964.

TRADE

The value of Thailand mineral commodity trade reached a new high of $345 million in 1967, while total trade, exclusive of military supplies, was $1,815 million. Thailand's balance of trade, however, remained adverse, with the negative balance increasing to $389 million as compared with $220 million in 1966. The balance of mineral commodity trade registered a substantial improvement, with the adverse balance being reduced from $139 million in 1966 to $103 million in 1967.

Thailand's principal 1967 mineral export continued to be tin, valued at $65 million, or nearly 54 percent of total exports. Iron ore and petroleum product

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exports, excluding petroleum bunkers, were second. Iron ore exports were valued at $4 million, and petroleum products at $3.7 million.

Imports of mineral fuels valued at $76 million were replaced in importance by imports of semimanufactured iron and steel products valued at $86 million. Japan was the major source of semimanufactured iron and steel products. The Middle East countries were the major suppliers of crude oil, with India, Indonesia, and Kuwait providing most of the refined products.

The following tabulation summarizes Thailand's mineral and total trade for 1966 and 1967, excluding trade in military supplies:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total trade	
Exports:			
1966	87	705	12.3
1967	121	713	17.0
Imports:			
1966	226	925	24.4
1967	224	1,102	20.3
Trade balance:			
1966	−139	−220	XX
1967	−103	−389	XX

XX Not applicable.

Table 2.—Thailand: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Antimony ore and concentrate	3,197	2,778	West Germany 2,093; Belgium 224; United States 181.
Iron ore—thousand tons	720	496	All to Japan.
Lead ore and concentrate	12,405	9,183	Netherlands 6,990; United Kingdom 1,400; Belgium 793.
Manganese ore and concentrate	66,453	80,353	Japan 71,001; Taiwan 7,787; Hong Kong 1,165.
Tin:			
Ore and concentrate—long tons	1,285	108	All to Japan.
Metal—do	17,315	26,572	United States 17,501; Netherlands 6,490; West Germany 1,775.
Tungsten ore and concentrate	817	888	Japan 292; Netherlands 219; United Kingdom 196.
NONMETALS			
Cement	45,423	33,817	Virtually all to Malaysia.
Feldspar, fluorspar and cryolite	73,670	125,752	Japan 119,945; India 4,586.
Salt—thousand tons	85	88	Malaysia 60; Singapore 22.
MINERAL FUELS			
Manufactured gas	33	------	
Petroleum:			
Crude thousand 42-gallon barrels (reexports).	------	119	All to Singapore.
Refinery products:			
Gasoline thousand 42-gallon barrels	r 74	121	Singapore 106; Laos 15.
Kerosine and jet fuel—do	r 8	5	All to Laos.
Distillate fuel oil—do	r 10	82	Singapore 45; Laos 24.
Residual fuel oil—do	r 1,577	920	Singapore 798; India 52; West Germany 25.
Lubricants—do	19	30	India 27; Laos 2.
Other—do	14	173	South Vietnam 132; Indonesia 25; Japan 13.
Total—do	r 1,702	1,331	
Bunkers—do	215	169	XX

r Revised. XX Not applicable.

Source: Thailand Department of Customs.

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Table 3.—Thailand: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum, metals and alloys:			
Unwrought	3,915	4,571	United States 3,316; Canada 985; Hong Kong 75.
Semimanufactures	2,804	3,538	Japan 1,612; West Germany 469; Switzerland 379.
Copper and alloys:			
Unwrought	455	370	United States 299; United Kingdom 66.
Semimanufactures	3,625	5,185	Japan 3,828; West Germany 733; Italy 208.
Iron and steel:			
Scrap	4,365	25,110	Belgium 9,654; West Germany 3,846; United Kingdom 1,970.
Ferroalloys	NA	2,332	Republic of South Africa 1,260; Norway 294; Taiwan 288.
Semimanufactures	555,249	657,359	Japan 396,113; India 73,320; Hong Kong 58,992.
Lead:			
Metals and alloys:			
Unwrought	1,362	1,667	Australia 1,615.
Semimanufactures	103	76	Belgium 24; West Germany 22; Japan 21.
Mercury—76-pound flasks	359	17	Japan 9; West Germany 4; United States 3.
Nickel, all forms	353	230	Japan 75; United Kingdom 60; West Germany 46.
Silver and alloys, all forms. thousand troy ounces	454	168	West Germany 60; Hong Kong 53; India 42.
Zinc:			
Metals and alloys:			
Unwrought	11,595	16,650	Australia 12,705; Japan 1,988; Canada 1,296.
Semimanufactures	2,584	2,208	Poland 1,374; Japan 389; West Germany 112.
NONMETALS			
Asbestos, crude	16,595	24,107	Republic of South Africa 11,428; Canada 7,972; Cyprus 2,722.
Cement	262,998	312,286	Taiwan 149,665; Japan 84,517; Malaysia 77,313.
Clays and refractories:			
Crude clay n.é.s	2,674	4,208	Czechoslovakia 2,002; United States 812; Japan 743.
Clay construction materials:			
Refractory	4,196	11,273	Japan 6,930; Taiwan 1,761; West Germany 840.
Nonrefractory	10,741	11,470	Japan 7,184; West Germany 2,051; Czechoslovakia 714.
Fertilizer materials, manufactured:			
Nitrogenous	51,029	57,485	Japan 29,791; West Germany 20,550; Netherlands 2,521.
Phosphatic	49,439	88,870	Japan 68,812; United States 12,917; Netherlands 4,698.
Potassic	2,119	3,259	France 2,000; Japan 526; West Germany 353.
Mixed	38,841	67,897	West Germany 29,337; Japan 13,687; Malaysia 8,530.
Pumice, emery, corundum and other natural abrasives.	868	1,169	Netherlands 757; United Kingdom 251; West Germany 58.
Sulfur (elemental)	11,172	15,955	United States 12,703; Italy 1,040; France 935.
Talc, soapstone, and steatite	2,008	2,056	South Korea 1,600; India 230; Japan 115.
MINERAL FUELS			
Coal	1,357	2,075	United States 2,045.
Coke	4,219	5,991	United States 1,990; India 1,815; Netherlands 985.
Carbon black	2,977	3,557	United States 1,851; Japan 952; West Germany 485.
Liquefied petroleum gas and manufactured gas.	1,899	4,276	Indonesia 1,831; Singapore 1,397; Japan 494.
Petroleum:			
Crude—thousand 42-gallon barrels	16,071	16,034	Persian Gulf countries 10,318; Iran 1,899; Saudi Arabia 1,482.
Unfinished oils—do	58	-------	
Refinery products:			
Gasoline—do	1,720	1,862	India 286; Iran 230; Indonesia 229.
Kerosine—do	376	305	Kuwait 65; Singapore 57; Malaysia 56.
Jet fuel—do	9,634	7,689	NA.
Distillate fuel oil—do	3,685	4,462	India 974; Kuwait 782; Iran 755.
Residual fuel oil—do	1,027	1,442	Indonesia 874; India 201; Kuwait 195.
Lubricating oil—do	544	582	Singapore 281; United States 210; Japan 56.
Asphalt—do	35	34	Singapore 23; Iran 5.
Petrolatum and wax—do	44	39	Indonesia 21; Japan 6; United States 2.
Other—do	34	119	Indonesia 72; Japan 10; United States 10.
Total—do	17,099	15,984	

NA Not available.

Source: Thailand Department of Customs.

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COMMODITY REVIEW

METALS

Aluminum.—Late in 1968 Aluminium Limited of Canada, a subsidiary of Alcan Aluminium, Ltd., announced that an agreement was signed with P. Piya Company, Ltd., a Thai company, providing for the formation of a new firm. Alcan Thai Company, Ltd., the new company, will take over the assets of P. Piya Company, Ltd., and the management will be appointed by Aluminium Limited of Canada. Each of the parties will hold a 50-percent interest in the new firm. P. Piya Company currently operates a 1,650-ton aluminum extrusion press and anodizing facilities.

Antimony.—Output and exports of antimony dropped sharply in 1968 owing to the closure of most of the small mines and reduced output of the one large mine located at Bansong in Surat, southern Thailand. Most of the readily accessible and economically recoverable ore at Bansong is mined out. Unless new deposits are discovered, antimony production will probably cease altogether in the very near future.

Copper.—During 1968 a number of foreign firms, including some from the United States, expressed interest in exploring or developing the copper resources of the northeast. Reportedly several firms have filed applications for mining rights.

The Phelps Dodge Corp. bought a 60-percent interest in an existing Thai concern engaged in the manufacture of copper wire and cable. During the year, Phelps Dodge completed construction of one of the most modern copper wire and cable plants in southeast Asia.

Iron and Steel.—Although Thailand does not have an integrated steelworks, there were over a dozen steel mills in the country with a similar number either under construction or planned. Currently, annual finished steel output ranges between 270,000 and 300,000 tons per year. Reinforcing bars were the major product, amounting to about 32,000 tons annually.

During 1968 the G. S. Steel Company Ltd. opened its plant in Samut Prakan, a suburb of Bangkok, with an initial capacity of 320 tons of steel ingot per day. The company also operated a steel rolling mill that produced steel round bars 6 to 25 mm in diameter at the rate of 30 tons per hour. The company planned to invest $15 million in sponge iron production that will use local iron ore. Scrap import will then be stopped, resulting in a foreign exchange saving of $7.5 million per year. The Siam Iron and Steel Company, Ltd., a subsidiary of Siam Cement Company, contracted the services of Hayek Engineering A.G. of Switzerland for the complete engineering and contracting services required to build a steel mill at Ta Luang. When completed, the mill will have a capacity of 150,000 to 200,000 tons per year of reinforcing bars and sections.

At yearend, three other steel mills were in the planning stage. Bangkok Steel Industry Company, Ltd., was planning to establish another steel mill at Phra Pradaeng, the same site as the company's existing mill. The new plant's estimated annual capacity will be between 240,000 and 300,000 tons of bars. The Thai concern Sahaviriya Panich Co., together with the Japanese Fuji Steel and Marubeni-Iida, plan to form a new company, the Sahaviriya Light Gauge Steel Co., Ltd., to produce 800 tons of light steel sections per month. Finally, the Indian Government has sanctioned the construction of a re-rolling steel mill at Bangkok with Indian collaboration for the production of iron rods and bars.

One of the most significant plans under discussion during 1968 was the proposed construction of an integrated steel mill to supply the entire Southeast Asia area with all its steel requirements. Plans for a jointly owned complex comprised of the Singapore blast furnaces and Thai rolling mills have been detailed in two separate reports. The Koppers Co. Inc. of Pittsburgh, Pennsylvania, prepared one of the reports, and the second was prepared by the five major steelmakers of Japan. The Thailand Board of Investment, however, was awaiting a Japanese Government-sponsored report on how the steel industry should be developed in Southeast Asia before considering either plan.

Lead and Zinc.—During 1968 the United States firm, National Lead Co., conducted feasibility studies concerning the development of the Mae Sod zinc deposits located

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in northern Thailand near the border of Burma. National Lead was granted a concession to this area in 1967. Late in 1968, however, the concession was revoked because of the low prevailing price of zinc.

Manganese.—Manganese production dropped sharply in 1968 owing primarily to substantially decreased exports to Japan, Thailand's best customer. Preliminary trade data for 1968 indicates that shipments to Japan will be less than half those for 1967.

Tin.—Thailand's 1968 production of tin-in-concentrates increased slightly over the previous year owing in part to export controls inaugurated by the International Tin Council in September 1968. Production and export controls were necessitated by a growing surplus of tin and declining world prices. For the period September 19 to December 31, 1968, Thailand's export quota was set at 6,344 long tons, and for the January 1, 1969 to March 31, 1969, period the quota is 5,613 long tons. Despite export and production controls, Thailand's second 5-year plan, 1967–72, expects an 8-percent annual increase in tin output. To accomplish this objective the Government is contributing $23 million for tin mining and development.

Thailand is expected to turn increasingly to seabed deposits of tin to maintain her output. During the year, over 50 companies had applied for offshore concessions, including nine international companies. These companies are: Compagnie Internationale De L'etain (Cometain) of Belgium; Union Carbide Corp. of the United States; Ocean Mining A.G., a U.S. company registered in Australia; Yip In Tsoi and Company, a joint venture between the Thais and Billiton of the Netherlands; N.V. Billiton Maatschappij of the Netherlands; Undersea Engineering and Construction, a United States company; Southern Kinta Consolidated Ltd. of the United Kingdom; Tongkah Harbour Tin Dredging Ltd. of the United Kingdom; and the Siamese Tin Syndicate Ltd., also of the United Kingdom.

During 1968, Southern Kinta Consolidated Ltd. placed into operation their Takuapa suction dredge, the first of its kind to be used in offshore tin mining. Aokam Tin Limited also placed a new bucket dredge into operation during the year. The addition of these two dredges is expected to check the downward trend in tin production by Thailand's dredging sector.

NONMETALS

Barite.—The announcement that a new firm was to be organized for mining and dressing barite ore made Thailand's prospects for becoming self-sufficient in barite excellent. The United States company, International Minerals & Chemical Corp., together with the Thai company, Mae Huey Yai Mining Company, plan a new company in which the United States firm will hold a 51-percent interest and the Thai company will hold the balance. Present plans call for the opening of a mine and the construction of a mill in southern Songkhla province, the location of extensive barite deposits. At a later date reserves in the neighboring Yala province will be mined and processed.

Cement.—The combined cement production capacity of Thailand's two cement manufacturers was about 2.4 million metric tons per year. Planned expansion of these two firms, Siam Cement Company, Ltd., and Cholpratan Cement Company, Ltd., will increase their combined capacity to 2.54 million metric tons by early 1969.

A new Thai-owned company, the Siam City Cement Company, was formed during the year and was awaiting government approval for the commencement of construction activities. This company had requested permission to build a cement plant in Saraburi with an initial annual capacity of 500,000 long tons or more. A Thai-Japanese group had also expressed interest in building a cement plant at Phrakanong with a production capacity of 1,500 to 2,000 long tons of cement per day.

Fertilizer Materials.—Thailand's consumption of both straight and blended fertilizers has increased at an extremely rapid rate in the last several years. In 1966 consumption was estimated at only 141,000 metric tons compared with predicted sales of 260,000 to 300,000 tons for 1968.

During 1968 Standard Oil Company (New Jersey) completed a $100,000 fertilizer blending plant in Thailand. Supplies of urea will probably be imported from Japan and diammonium phosphate from either the United States or the Philippines.

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In response to requests from the Thai-owned Chemical Fertilizer Company Ltd., the Thailand cabinet banned the import of ammonium sulfate and urea in June 1968 to protect the company from imports of lower-priced fertilizers. The high operating costs of the company owing to the utilization of lignite as a basic feedstock makes it impossible for them to compete with lower-priced imports, particularly from West Germany.

Fluorspar.—The production of fluorspar has increased so rapidly in recent years that it may soon replace iron ore as Thailand's second most important mineral commodity. Production rose from 3,460 tons in 1960 to 133,152 tons in 1967, and to 245,097 tons in 1968. Owing to the ore's increasing importance, the Department of Mineral Resources called a nationwide conference of fluorspar producers, buyers, and government officials in October 1968. From the meeting it became apparent that the Department wishes to encourage consolidation of production and to promote producer cooperation and an upgrading of the industry.

The main fluorspar mining areas of Thailand are the northern provinces of Chiang Mai, Lamphun, and Lampang. These three provinces account for 92 percent of current production.

At yearend, a new company was formed to develop Thailand's fluorspar deposits for the export market. The joint Thai-American company, the Thai Fluorspar Products Company, Ltd., plans to build the country's first fluorspar processing plant, which will produce metallurgical, acid, and ceramic grade concentrates. The entire output is to be exported, because there is no market for fluorspar in Thailand. As well as export benefits, the existence of a processing plant will permit fluorspar mine operators to produce lower-grade ore, thereby increasing their reserves and lowering mining costs.

Gypsum.—Gypsum production, in response to requirements of Thailand cement manufacturers, increased appreciably during 1968. Exports of small amounts, as in the past, went to Malaysia. Although Thailand's gypsum deposits are large, increased exports will depend upon the development of economical ore transport to shipping ports as well as favorable prices.

MINERAL FUELS

Lignite.—Production of lignite remained at nearly the same level as that of 1967. Requirements for the country's two main outlets, the thermal power station at Krabi, South Thailand, and the fertilizer plant at Mae Moh, were at about the same level in 1968 as in 1967.

Petroleum.—Little exploratory work was completed during 1968 by the six companies which had received concession areas in the Gulf of Siam in late 1967. Continental Oil Company and Tenneco Inc. have conducted marine seismic work; British Petroleum Company, Ltd. has run aeromagnetometer surveys.

In late 1968 Standard Oil Company (New Jersey) awarded a contract for the design and expansion of their refinery at Sriraja to Foster Wheeler, Ltd. Capacity is to be increased from 7,000 barrels per day to 35,000 barrels per day by 1970. The expanded Bangchak Petroleum Refinery, with a capacity of 20,000 barrels per day, went on stream in May 1968. During the year, work was also underway at the Thai Oil Refining Company's refinery at Sriraja. Capacity of this refinery is to be increased from 33,000 barrels per day to 65,000 barrels per day at a cost of about $40 million.

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The Mineral Industry of Tunisia

By Eugene R. Slatick[1]

The mineral sector of Tunisia's economy continued to grow in 1968. Despite rising competition in world markets and a rapid rise in indigenous oil production, the phosphate industry remained the country's most important mineral industry.[2] In early 1968 the mining labor force totaled approximately 14,000, including about 9,600 in the phosphate mines.

Foreign assistance agreements were entered into with Bulgaria, Rumania, and Yugoslavia during the year which provided credit for mining equipment. Repayment will be made in phosphate rock to Bulgaria and in phosphate rock and other nonferrous concentrates to Rumania. The terms with Yugoslavia were not available as of yearend 1968; presumably they will include at least partial repayment in phosphate rock. Rumania will also provide assistance in geological prospecting and in developing phosphate and other nonferrous metal mines.

The World Bank approved a loan of $8.5 million[3] to improve three of Tunisia's major ports, La Goulette, Bizerte, and Sfax. The loan is for 30 years, including 10 years of grace, at an interest rate of 6.5 percent. Tunisia's ports play an important role in the country's mineral economy. In 1967 they handled about 7.5 million tons of cargo, about 70 percent of which consisted of mineral commodities.

PRODUCTION

The overall pattern of mineral production was estimated to have remained essentially unchanged in 1968. Output of several mineral commodities continued to rise steadily and showed large increases as compared with production in 1967. These commodities were pig iron, steel ingots and castings, steel semimanufactures, crude oil, and petroleum refinery products. Fluorspar production, which had been declining, rose sharply in 1968.

[1] Foreign mineral specialist (Petroleum) Division of International Activities.

[2] Sizer, H. S. Minerals Industry, 1967 and 1968. U.S. Embassy, Tunis, State Dept. Airgram A-131, May 19, 1969, 8 pp. (This report provided information for several parts of this chapter.)

[3] Where necessary values have been converted from Tunisian dinars (TD) to U.S. dollars at the rate of TD1 = US$1.905.

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Table 1.—Tunisia: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Iron and steel:					
Iron ore and concentrate—thousand tons	939	1,117	r 1,287	918	1,016
Pig iron—do	--------	--------	• 50	98	p 128
Steel, ingots and castings—do	--------	--------	• 45	• 45	p 80
Steel semimanufactures—do	--------	--------	• 40	• 50	p 80
Lead:					
Mine output, metal content	12,650	15,870	15,931	12,447	• 14,500
Metal:					
Primary	12,094	15,428	15,312	13,245	14,024
Antimonial	846	1,250	1,339	355	
Mercury, metal, primary—76-pound flasks	87	174	254	292	• 300
Silver, metal, primary—troy ounces	12,635	33,758	38,002	44,722	• 46,000
Zinc, mine output, metal content	3,339	4,737	5,794	4,152	• 5,100
NONMETALS					
Cement, hydraulic—thousand tons	455	454	478	472	• 470
Clays, construction—do	44	• 100	• 200	220	• 250
Fertilizer materials:					
Crude (natural), phosphate rock—do	2,751	3,040	3,216	r 2,886	3,444
Manufactured:					
Hyperphosphate—do	101	110	65	6	15
Superphosphate—do	NA	NA	29	31	35
Triple superphosphate—do	• 152	• 248	271	324	376
Fluorspar, all grades	--------	• 3,000	2,625	• 2,500	5,450
Gypsum and anhydrite, crude—thousand tons	• 18	• 18	• 18	• 10	• 10
Lime, hydraulic—do	175	174	172	170	• 170
Salt, marine—do	214	356	328	241	360
MINERAL FUELS AND RELATED MATERIALS					
Gas, natural, marketed—million cubic feet	293	301	312	328	• 340
Petroleum:					
Crude oil—thousand 42-gallon barrels	--------	--------	4,741	17,068	23,503
Refinery products:					
Gasoline and naphtha—do	785	964	1,037	1,258	• 1,600
Kerosine—do	327	398	398	484	• 580
Distillate fuel oil—do	1,311	1,616	1,639	1,832	• 2,400
Residual fuel oil—do	1,696	2,055	2,501	2,239	• 2,900
Liquefied petroleum gas—do	69	97	128	172	• 220
Total—do	4,188	5,130	5,698	r [2] 6,266	• 7,700

• Estimate. p Preliminary. r Revised. NA Not available.

[1] In addition to commodities listed, construction materials such as sand, gravel, and quarried stone are also produced, but quantitative data are not available.

[2] Includes 331,000 barrels of other products, including bases and intermediates.

TRADE

By value, Tunisia's chief mineral exports in 1967 continued to be fertilizer materials (phosphate rock, $23.9 million; manufactured phosphate, $21.1 million), but crude oil gained in significance ($20 million, up from $8 million in 1966). A comparison of the total value of mineral commodity trade with that of total commodity trade for recent years is given as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	53.6	119.8
1966	56.7	140.4
1967	82.0	149.3
Imports:		
1965	44.8	245.0
1966	50.6	249.0
1967	48.2	261.2

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Table 2.—Tunisia: Exports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	186	141	All to Italy.
Copper, metal, including alloys, all forms	983	557	Belgium-Luxembourg 230; France 116; Hungary 77.
Iron and steel:			
Ore and concentrate—thousand tons	876	775	Italy 389; Greece 180; United Kingdom 123.
Metal:			
Scrap	5,263	21,834	Italy 15,778; Yugoslavia 4,914.
Pig iron, ferroalloys and similar materials	15,928	81,066	Italy 44,518; Switzerland 26,430.
Steel, ingots and other primary forms	750	2,220	Belgium-Luxembourg 1,740; Gibraltar and Malta 420.
Semimanufactures	75	12,405	Saudi Arabia 3,852; Italy 3,292; Spain 2,934; Morocco 1,998.
Lead:			
Ore and concentrate	136	1,472	All to France.
Metal, unwrought	13,002	12,230	Italy 4,586; Czechoslovakia 3,235; France 1,221.
Mercury—76-pound flasks	r 29	145	Netherlands 87; Belgium-Luxembourg 58.
Silver, metal, including alloys—troy ounces	23,663	32,151	All to France.
Zinc, ore and concentrate	10,980	13,338	France 5,447; Italy 4,800; United Kingdom 3,090.
Other:			
Ore and concentrate, nonferrous, n.e.s	889	------	
Scrap, nonferrous, n.e.s	28	408	Italy 330; Belgium-Luxembourg 78.
NONMETALS			
Cement	------	1,770	All to Gibraltar and Malta.
Clays and clay products (including refractory brick)	r 17,555	32,335	Mainly to Libya.
Feldspar and fluorspar	2,908	1,994	All to Italy.
Fertilizer materials:			
Crude, phosphatic—thousand tons	2,400	2,314	France 591; Yugoslavia 312; Poland 255.
Manufactured:			
Phosphatic—do	169	382	Turkey 123; Bulgaria 94; France 40.
Other, including mixed	1,139	NA	
Salt—thousand tons	276	278	United States 211; Finland 27.
Stone, dimension, worked	561	13	France 8; Libya 3.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets	------	10	All to Libya.
Coke and semicoke	------	14	Do.
Petroleum:			
Crude—thousand 42-gallon barrels	4,745	12,058	West Germany 6,711; Switzerland 2,253; France 2,057.
Refinery products:			
Gasoline and jet fuel—do	661	689	All to Italy.
Distillate fuel oil—do	84	152	Italy 149; Bunkers 2.
Residual fuel oil—do	67	5	Bulgaria 4; Bunkers 1.
Total—do	812	846	

r Revised. NA Not available.

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Table 3.—Tunisia: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Alumina	121	115
Metal, including alloys	416	580
Copper, metal, including alloys, all forms	547	1,181
Gold, metal, unworked or partly worked—		
thousand troy ounces	26	23
Iron and steel:		
Metal:		
Scrap	115	65
Pig iron, ferroalloys, and similar materials	726	449
Steel, primary forms:		
Ingots and other	9,996	17,180
Semimanufactures:		
Angles, shapes, and sections	46,113	26,441
Universals, plates and sheets	12,168	19,539
Hoop and strip	806	1,587
Rails and accessories	16,176	4,613
Wire	3,800	5,763
Tubes, pipes, and fittings	26,873	13,013
Castings and forgings, rough	2,883	2,595
Total	108,819	73,551
Lead, metal, including alloys, all forms	149	117
Mercury—76-pound flasks	40	9
Nickel, metal, including alloys, all forms	11	8
Silver, metal, including alloys, all forms—troy ounces	17,072	37,006
Tin, metal, including alloys, all forms—long tons	31	42
Zinc, metal, including alloys, all forms	159	232
Other:		
Ore and concentrate, metallic, mainly nonferrous	165	------
Oxides, metallic, mainly for paint	738	80
Metals, nonferrous, n.e.s	30	------
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum; mainly pumice	263	26
Grinding stones and wheels	74	52
Asbestos	2,981	2,165
Barite and witherite	1,191	2,891
Cement	13,577	43,838
Chalk	90	88
Clays and clay products (including refractory bricks):		
Clays, n.e.s	4,348	8,764
Crude products: Refractory (including nonclay bricks)	r 11,919	10,758
NONMETALS—Continued		
Diatomite and other infusorial earths	67	38
Feldspar and fluorspar	251	1,208
Fertilizer materials:		
Manufactured:		
Nitrogenous	20,182	21,505
Potassic	3,547	3,479
Other	------	151
Ammonia	548	555
Graphite, natural	10	3
Gypsum and plasters	400	403
Magnesite	55	10
Mica, all forms	9	1
Precious and semiprecious stone, except diamond:		
Gem stones, precious and semiprecious—kilograms	2	------
Sodium and potassium compounds, n.e.s.:		
Caustic potash	36	21
Caustic soda	3,820	3,923
Stone, sand and gravel:		
Dimension stone	1,371	4,561
Dolomite, chiefly refractory grade	282	131
Gravel and crushed stone	334	395
Quartz and quartzite	375	1,400
Sulfur:		
Elemental, all forms	130,250	124,156
Sulfur dioxide	126	85
Sulfuric acid	5,745	11,193
Pyrite, unroasted	7,983	7,766
Talc, steatite, soapstone, and pyrophyllite	350	441
Other:		
Minerals, n.e.s	4,353	4,589
Elements and compounds, n.e.s	270	27
Manufactures, n.e.s	290	------
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	29,614	37,637
Coke and semicoke	55,867	108,185
Petroleum:		
Crude—thousand 42-gallon barrels	5,405	2,073
Refinery products:		
Gasoline—do	12	6
Kerosine—do	34	11
Residual fuel oil—do	22	107
Lubricants—do	97	75
Asphalt and bitumen—do	99	86
Other—do	3	39
Total—do	267	324
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r 47	10

r Revised.

COMMODITY REVIEW

METALS

Iron and Steel.—Iron ore was mined at Djebel Djerissa (about 200 kilometers southwest of Tunis) and Tamera-Douaria (near the northwest coast). Because the Djebel Djerissa mine has the highest grade ore, most of its output was exported

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in order to maximize foreign exchange earnings.

During the year the blast furnace at the El Fouladh Iron and Steel Mill, at Menzel Bourguiba, near Bizerte, surpassed its rated annual operating capacity of 120,000 tons for the first time since it began operations in 1966. A tender was issued in 1968 to construct and equip a wire drawing plant at the mill.[4] Initially, the annual capacity of the plant is to be about 9,000 tons of wire of varying sizes and types; later, it would be increased to 16,000 tons.

Lead and Zinc.—Further evaluation of the lead-zinc deposits found by the United Nations Development Program in the Foussana Region in 1967 indicates total reserves of about 5 million tons of ore with an average lead-zinc content of about 5.5 percent. The deposits are considered to be marginally economical; exploitation could be justified if the deposits were developed efficiently. Other lead-zinc deposits in the area are worked by primitive methods. Roads and a railroad are in the area, which is about 240 kilometers south of Tunis. The exploration leading to the discovery of the new reserves was financed by the Tunisian Government ($500,000) and the United Nations Development Program ($922,500).

NONMETALS

Fertilizer Materials.—Tenders were invited during the year to build a 100,000-ton-per-year phosphoric acid plant, a diammonium phosphate plant, and a sulfuric acid plant.[5] The plants will be part of the fertilizer complex being constructed at Gabes for Industries Chimiques Maghrébines S.A.

Late in the year the Governments of Tunisia and Libya signed an agreement to coordinate their petrochemical industries. Tunisia is to concentrate on producing superphosphates, compound fertilizers, and phosphoric acid; Libya, on manufacturing ammonia and ammonium derivatives. Each country is to import its product requirements from the other.

Tunisia's phosphate rock mining companies are all under governmental control. Compagnie des Phosphates et du Chemin de Fer Gafsa (GAFSA) has mines located west of Gafsa, at Metlaoui, Moulares, and Redeyef; Compagnie Tunisienne des Phosphates du Djebel M'Dilla (CIPHOS) has mines located south of Gafsa, at Djebel Sehib and M'Dilla; and Société Tunisienne d'Exploitation Phosphatière (STEPHOS) has mines located south of Le Kef, at Ain Kerma and Kalaa Djerda. The equipment and methods used at the Djebel Sehib mine of CIPHOS were described in an article published during the year.[6]

Fluorspar.—A fluorspar processing plant was inaugurated in April at Zaghouan, south of Tunis, but commercial operations reportedly did not begin during the year.

MINERAL FUELS

Petroleum.—Tunisia's crude oil reserves in 1968 were estimated at 468 million barrels.[7] They ranked fifth in Africa and accounted for about 1 percent of the continent's total oil reserves.

The Douleb field began production in April, giving Tunisia two producing oilfields. The other field, El Borma, began production in 1966. Douleb is about 170 kilometers southwest of Tunis; El Borma is farther south, near the Algerian border.

Crude oil production during the year averaged 64,392 barrels per day. In midyear, El Borma had 36 flowing wells, and Douleb had four.[8] El Borma is operated by Société Italo-Tunisienne d'Exploitation Pétrolière (SITEP), and Douleb jointly by Société Aquitaine-Tunisie and Société de Recherches et d'Exploitation des Pétroles en Tunisie (SEREPT). Oil from both fields is piped to La Skhirra. The line from Douleb (6-inch diameter, 173 kilometers long) was completed early in 1968.

Natural gas continued to be produced only from SEREPT's Cap Bon gasfield, from where it was piped to Tunis, about 50 kilometers to the west. Tunisia's gas reserves in 1968 were estimated at 500 billion cubic feet.[9]

The Government has a share in all oil and gas production through its holdings in SITEP (50 percent share) and SEREPT (24 percent share). During the year, two permit areas were granted and two were relinquished. Société Aquitaine-Tunisie re-

[4] International Commerce. V. 74, No. 39, Sept. 23, 1968, p. 34.
[5] Phosphorus and Potassium. No. 36, July–August 1968, p. 8.
[6] World Mining. V. 4, No. 9, August 1968, pp. 25–27.
[7] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 103.
[8] Page 120 of source cited in footnote 7.
[9] Page 103 of source cited in footnote 7.

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ceived a 13,000-square-kilometer area in central Tunisia that is contiguous with the Centre Nord concession, which contains the Douleb field. Compagnie Française des Petroles (CFP) received a 15,000-square-kilometer area covering both inland and offshore areas in the Sfax-Kerkennah region. The relinquished areas, totaling 18,600 square kilometers in central Tunisia, had been held by a group comprised of Amerada Petroleum Corp., Continental Oil Co., and Marathon Oil Co., the only U.S. oil interests in the country.

Société Aquitaine-Tunisie announced during the year that in December 1967 an agreement had been concluded with the Tunisian Goverment concerning the offshore Gulf of Gabès permit, which the company owns jointly with Entreprise de Recherches et d'Activities Pétrolières (ERAP). The two companies agreed to establish a new company, Société Franco-Tunisiene d'Exploitation Pétroliere (SOFRATEP), in which the Government is entitled to a 50-percent participation if oil is found.[10] The offshore rig Neptune Gascogne began drilling for SOFRATEP in June. No discoveries were reported.

During the year details were completed on an agreement reached in 1967 to delimit the border between Tunisia and Algeria, particularly as it pertains to the El Borma field, which extends into Algeria. Under another agreement concluded in 1968, Rumania is to provide technical assistance and equipment to help the Tunisian Government search for petroleum in areas not yet under concession. Late in the year the Governments of Tunisia and Italy resumed negotiations regarding the demarcation of the offshore area between Tunisia and Sicily.

Plans to build a second refinery were announced by Ente Nazionale Idrocarburi (ENI), which owns the 22,500-barrel-per-day Bizerte refinery jointly with the Tunisian Government. The proposed refinery, costing about $10 million, will be part of an industrial complex being built at Gabès, just south of La Skhirra. Using oil from the El Borma field, the refinery is to supply feedstock to the complex. Tunisian oil destined for the Bizerte refinery must be shipped from La Skhirra, a distance of about 480 kilometers.

[10] Petroleum Press Service. V. 35, No. 6, June 1968, p. 233.

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The Mineral Industry of Turkey

By E. Shekarchi [1]

Gross value of 1967 mineral and metal production in Turkey apparently increased by 12.8 percent or to $522.7 million [2] and represented 4.9 percent of the gross national product (GNP). Copper, boron minerals and chromite remained Turkey's main contribution to the world mineral supply.

Turkey recorded another total GNP growth in 1968 with $11.5 billion compared to $10.6 billion in 1967. Per capita GNP, $324 in 1967, was increased to $334 in 1968.

Maden Tetkik ve Arama Enstitüsü (MTA), the Mineral Research and Exploration Institute, continued its diversified exploration program with the assistance of foreign geologists. Mapping programs of MTA progressed satisfactorily and a geological map for most of the country at 1:125,000 scale is now available.

At the close of the U.S. fiscal year 1967, approved U.S. Agency for International Development (AID) project loans to Turkey totaled $69.9 million. Of these, the largest loan related to the minerals industry, $30.5 million for the Black Sea copper works, and is aimed at developing Turkey's copper resources. The second largest loan of $22.4 million was for expansion of the Eregli steel mill. In addition $2.6 million was loaned for a mineral exploration and training program.

The United Nations Development Program was slated to undertake an intensive mineral exploration project in Anatolia or Menderes Massif at a cost of $1.04 million.

PRODUCTION

No gross values for mineral production were available for 1968; however, impressive tonnage gains were noted in the production of antimony, manganese, and lead-zinc when compared with the levels of the previous year. Noteworthy increases in nonmetal commodity production were registered in the output of crude magnesite, cupreous pyrite, crude oil, and refinery products.

Available information on the gross value of mineral production in 1967 indicates a 12.8-percent increase over that of 1966 and a similar increase was expected in 1968 mineral production values.

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[1] Foreign minerals specialist, Division of International Activities.

[2] Where necessary, values have been converted from Turkish lira (TL) to U.S. dollars at the rate of TL1=US$0.11.

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Table 1.—Turkey: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Aluminum: Bauxite	4,469	10,283	32,380	21,490	NA
Antimony:[2]					
Ore and concentrate	3,294	3,534	3,081	2,035	3,126
Regulus	58	107	130	55	125
Chromite (all grades)	412,685	567,062	511,645	r 371,138	e 2 603,100
Copper:					
Mine production (contained metal)	34,500	33,600	36,400	30,988	28,823
Blister from other domestic ore	25,981	26,300	26,617	25,390	28,620
Ferrochromium	4,821	7,473	7,000	8,471	8,500
Iron and steel:					
Iron ore—thousand tons	976	1,530	1,620	1,485	1,989
Pig iron and blast furnace ferroalloys—do	401	500	822	847	910
Steel ingots—do	486	666	939	1,056	1,109
Lead:					
Content of concentrate	1,626	1,682	935	2,358	2,216
Metal	1,960	918	r 1,500	2,156	e 2,000
Manganese ore	20,290	14,220	22,268	r 17,307	25,350
Mercury—76-pound flasks	2,615	2,755	3,420	r 4,147	4,320
Zinc:					
Zinc-lead ore, hand-sorted	12,500	16,548	16,620	18,448	24,392
Zinc ore, calcined	8,950	8,500	7,150	7,150	11,900
Zinc concentrate	1,858	1,758	1,768	1,842	1,333
Zinc content of ore and concentrate	5,686	7,000	3,420	3,689	4,878
NONMETALS					
Asbestos	1,171	1,248	1,141	2,196	3,183
Barite	6,050	11,980	18,680	31,590	20,293
Boron minerals	128,254	170,977	225,286	287,607	265,883
Cement—thousand tons	2,940	3,328	3,865	4,249	4,733
Clay, including fire clay e—do	13,000	13,500	19,000	15,000	15,000
Emery	12,400	12,579	29,470	31,125	30,864
Fertilizer (chemical)	300,930	376,800	373,526	359,804	335,180
Fluorspar	1,303	1,077	1,505	e 1,500	2,004
Gypsum e—thousand tons	200	220	220	220	220
Magnesite (crude ore)	39,068	75,587	97,000	84,959	117,735
Marble e—cubic meters	15,000	15,000	19,000	e 30,000	50,000
Meerschaum—kilograms	24,100	99,400	57,200	67,510	39,300
Pyrite, cupreous (gross weight)	113,093	133,159	120,622	125,000	136,536
Salt, all types—thousand tons	355	493	300	e 400	567
Sodium sulfate	2,425	4,963	7,423	11,289	11,037
Sulfur	22,200	22,299	22,650	25,384	24,180
MINERAL FUELS AND RELATED MATERIALS					
Bituminous coal (salable)—thousand tons	4,448	4,401	4,893	5,031	2 7,506
Coke, all types—do	1,111	1,431	1,449	1,362	1,430
Fuel briquets—do	55	50	30	e 50	e 50
Lignite (salable)—do	3,871	4,166	4,774	4,468	2 6,386
Petroleum:					
Crude—thousand 42-gallon barrels	5,894	9,818	13,062	17,459	19,871
Refinery products:					
Gasoline—do	5,388	5,933	4,412	6,774	8,391
Kerosine and jet fuel—do	3,809	3,791	3,794	3,040	4,912
Distillate fuel oil—do	8,515	8,270	9,469	9,393	11,221
Residual fuel oil—do	11,277	11,461	12,850	15,804	18,419
Liquefied petroleum gas—do	279	549	e 577	126	1,535
Other (includes asphalt, solvent, and miscellaneous)—do	1,023	1,285	e 1,406	899	1,151
Total—do	30,291	31,289	32,508	36,036	45,629

e Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, Turkey produced about 3 million metric tons of limestone and 380,000 metric tons of dolomite in 1968.

[2] Run of mine.

TRADE

The year 1967 was disappointing with regard to value of mineral exports which was down $8.6 million, or 17.1 percent, from 1966 values. Principal factors in the decline were reduced export sales of copper (16,078 metric tons compared with 19,919 metric tons in 1966) and decreased output of chromite which caused exports to drop to 312,972 tons from 508,722 tons in 1966. These two commodities constitute

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a large share of the total value of mineral exports. Borate exports continued their steady upward trend, reaching 211,332 tons, valued at $5.84 million, which was 20 percent above the 1966 record of $4.865 million.

The total value of mineral and metal imports declined by 14.7 percent in 1967 to about $139.5 million. Major changes were recorded in the import of steel bloom and ingots, down $3.9 million, and crude petroleum, down about $13.1 million. However, offsetting these was an increase of $2.3 million in value of imports of fuels and residual oils and $900,000 in steel semimanufactures.

Value of mineral commodities trade and value of total commodity trade are presented in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	r 50.1	490.5
1967	41.5	523.0
Imports:		
1966	r 154.2	718.3
1967	139.5	690.8

r Revised.

Table 2.—Turkey: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Antimony, ore and concentrate	2,909	2,627	Czechoslovakia 1,227; West Germany 1,000.
Chromite, metal, including alloys, all forms.	508,722	312,972	United States 97,062; Czechoslovakia 46,974; East Germany 36,548.
Copper, metal, including alloys, blister	19,919	16,078	Japan 9,010; Spain 5,319.
Ferrochromium	7,367	5,206	Hungary 2,800; France 1,000; United Kingdom 816; Italy 590.
Iron and steel	371	NA	
Lead, ore and concentrate	4,561	-------	
Manganese, ore and concentrate	6,711	5,880	Mainly to United States.
Mercury----76-pound flasks	3,111	4,543	United Kingdom 1,601; Japan 1,130; Netherlands 809.
Pyrite, cupreous	91,180	119,370	Italy 105,150; West Germany 14,220.
Tungsten, ore and concentrate (45 percent).	-------	27	All to Netherlands.
Zinc:			
Calcined ore	7,150	780	All to Bulgaria.
Concentrate	r 1,900	-------	
Lead sulfide ores	11,100	15,000	NA.
Metallic slags and scrap	-------	703	Sweden 531; Belgium 104.
NONMETALS			
Abrasives, emery	26,838	22,026	France 10,200; Netherlands 6,390; United States 3,404.
Asbestos	r 600	-------	
Barite	r 11,113	22,873	United States 16,721; Libya 6,137.
Borates	175,325	211,332	Italy 63,627; France 49,985; United States 21,559.
Magnesite:			
Crude	41,643	14,515	Austria 5,711; Belgium-Luxembourg 5,365.
Calcined	24,146	22,310	Austria 12,300; Switzerland 4,000; Belgium 2,460.
Meerschaum	29	110	Italy 70; Syria 4.
Salt	51,859	6,800	All to Japan.
Stone, sand and gravel, marble	8,037	2,912	Italy 1,156; West Germany 631.
Sulfur	r 4,180	-------	
Other nonmetals	131	135	NA.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous	9,947	2,801	All to Greece.
Petroleum refinery products:			
Gasoline	28,751	-------	
Residual fuel oil	387,894	-------	

r Revised. NA Not available.

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Table 3.—Turkey: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms:		
Ingots	8,232	9,275
Semimanufactures	2,874	4,673
Copper, metal, including alloys, all forms	515	746
Iron and steel, metal:		
Scrap	31,981	39,027
Pig iron, including cast iron	21,797	21,313
Ferromanganese and other ferroalloys	10,542	7,677
Ingots and other primary forms	193,181	123,998
Semimanufactures	207,248	91,705
Lead, metal, including alloys, all forms	2,575	4,861
Nickel, metal, including alloys, all forms	88	253
Tin, metal, including alloys, all forms	1,079	881
Zinc, metal, including alloys, all forms	5,902	6,134
Metallic ores, slags and ashes	569	457
Other nonferrous metals and semimanufactures	10	50
NONMETALS		
Asbestos	6,673	5,884
Barite	742	-------
Cement	163,867	178,458
Clays and clay products	1,414	1,789
NONMETALS—Continued		
Feldspar and fluorspar	306	3,792
Graphite	146	286
Infusorial earths	57	-------
Meerschaum, agglomerated	-------	366
Mica	-------	45
Phosphate rock	148,089	95,104
Quartz and quartzite	74	658
Stone, sand and gravel, crushed rock	r 160	231
Sulfur	105	601
Talc	-------	139
Other	-------	487
MINERAL FUELS AND RELATED MATERIALS		
Carbon black	r 7,427	-------
Coal	333	331
Coke	7,933	8,675
Petroleum:		
Crude—thousand tons	2,807	2,480
Refinery products:		
Gasoline	1,506	19,563
Kerosine	22,690	44,408
Fuel and residual oils	r 69,664	171,895
Lubricants	85,254	90,077
Pitch and residues	r 193	206
Other (paraffin and vaselines)	73,339	3,201
Total refinery products	252,646	329,350

r Revised.

COMMODITY REVIEW

METALS

Aluminum.—No bauxite production was reported for 1968 in spite of the successful trial operation in 1967 which produced 21,500 tons. The construction work on the aluminum plant at Seydişehir continued during 1968 and upon completion the plant will produce 60,000 tons of aluminum. The plant is being built under a contract which Etibank signed with Tiajpromexport of the U.S.S.R. on May 9, 1967. The contract requires procurement of $62 million worth of machinery, equipment and engineering services by the Russians. Repayment of the loan will be over a 15-year period at 2.5-percent annual interest. A new 270-megawatt hydroelectric plant will be built on the Manavgat River 90 kilometers from the plant at an additional cost of $60 million in Turkish currency.

Chromite and Ferrochromium.—Exports of chromite decreased in 1967 to 312,972 metric tons, off 38.5 percent from the 1966 level, even though somewhat higher prices were offered for Turkish ores. The decline apparently was due more to delivery inefficiency than to exhaustion of ore reserves.

Etibank (State sector) exported 101,898 metric tons to foreign buyers and delivered 18,737 tons of metallurgical grade concentrates to the Antalya ferrochrome plant. Reported production of Etibank's two operating mining districts was 128,101 tons from the eastern operation and 87,853 tons of milling and shipping grade ores from the Uçköprü district. Etibank reported 45,000 tons of carryover chromite ore in 1967.

During 1967 the private sector mines produced 48,773 metric tons of sorted ores and milled 365,363 tons from which 192,391 tons of concentrate was recovered. Leading producers in 1967 were Turk-Maadin with 97,285 tons of concentrate from its Kavak and Koçek mills plus 5,000 tons of ore from the Kavak mine, and Sitki Koçman with 70,000 tons of ore and concentrate.

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Ferrochrome output at the Etibank-Pechiney plant near Antalya was 8,500 tons in 1968. Studies were in progress regarding a 40,000-ton-per-day ferrochromium plant to utilize Keban Dam power.

Copper.—Production of blister copper in 1968 dropped to the lowest level in the last 5 years with a 7-percent decrease from 1967 output. Available figures on trade in blister copper indicate that in 1967 Turkey exported 3,841 metric tons less than in 1966. However, several increases in the overall price of copper products compensated for the quantitative decrease and Turkey received about $16.9 million from blister copper exports. One of the reasons given for the decrease in copper production was the declining reserves of high-grade direct smelting ores at Maden.

During 1968 Arthur G. McKee and Co. continued work on the Black Sea copper complex under a contract which was awarded in 1967. Terms of the contract include the development of a mining plant, a 8,500-metric-ton-per-day copper concentrator, and a 300,000-metric-ton-per-year sulfuric acid plant, as well as a 40,000-metric-ton-per-year smelter.

A 60-kilometer-long pipeline will be constructed to carry the copper concentrates from the mine at Murgul to the port of Hopa on the Black Sea coast where the concentrates will be shipped to Samsun to be used as feed for the new smelter. The approximate cost of the whole complex was given at $40 million and it is expected to be completed within 4 years.

Iron and Steel.—Production of iron ore reached a new high in 1968 with an increase of 34 percent over 1967 output. Pig iron and blast furnace ferroalloys, as well as steel ingot, registered production records in 1968 with increases of 7 percent and 5 percent, respectively, compared with 1967 figures.

Shipments of iron ore from private mines to the Eregli steel plant were somewhat greater in 1967 than in the preceding year; however, Karabük's Divrigi mines showed a large decrease in production and shipments in 1967 and were expected to follow the same trend in 1968. The comparison was made on the following table of shipments from both public and private mines in 1965, 1966, and 1967 for which data were available.

A $2.6 million iron ore exploration program that was agreed upon in 1967 between MTA and the U.S. Geological Survey was in full swing in 1968. Details of progress were not available since some of the investigated properties awaited more beneficiation tests and possibly pilot plant tests before concrete conclusions would be reached.

On May 7, 1968, the Government of Turkey and the U.S.S.R. signed a formal agreement calling for feasibility studies on the 1-million-metric-ton steel mill which is to be built at Iskenderun under the Soviet Industrial Aid credit. The Iskenderun steel mill, which will be Turkey's third integrated plant, apparently will be designed by a British consulting firm, John Miles and Partners from London, and built by the Soviets. It will have an initial annual capacity of 1.2 million metric tons of raw steel, increasing through expansion in the future to at least 2.5 million metric tons.

Table 4.—Turkey: Shipments of salable ore from selected iron ore mines

(Thousand metric tons)

Mine	Operator	1965	1966	1967
Divrigi	Karabük Steel	872	740	752
Çetinkaya	Demir Export (Koç)	141	237	205
Ötlukilise	----do	116	161	208
Deveci	Bilfer Mining	59	91	90
Karakuz	----do	59	68	33
Kesikkoprü	Kesikkoprü Mining	60	•65	•60
Büyük Egmir	Dümeks	37	45	51
Kuçuk Egmir	Mortas	-----	-----	24
Akdag	Necati Akin	31	30	25
Karamadazi	Özkoyuncu Mining	37	45	35
Çalti	Kepman	15	10	11
Miscellaneous	----------	39	•41	•40
Total shipments	----------	1,457	1,538	1,529

• Estimate.

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Reportedly ground breaking took place in 1968.

Lead and Zinc.—Production of lead-zinc ore in 1968 was 32 percent higher than in 1967.

A new company, Kayseri Cinko-Kuruşun Metal Sanayii A.S. was incorporated in 1968 to develop a major lead-zinc industry at Yeşilhisar, about 50 kilometers south of Kayseri. Of the total initial capital, 35 percent was contributed by the State-owned enterprise of Etibank, the Kayseri Workers' Credit Bank contributed 10 percent, and the remainder was taken by private companies.

The first activity of the company was to prove the reserves and determine the most suitable method for developing them. A drilling program was carried on in 1968; however, no detailed information on the exploration was available by yearend. It has been suggested that if exploration is successful and substantial reserves are shown, the company will install a plant with an initial capacity of 20,000 metric tons followed with expansion programs to reach 60,000 metric tons.

Manganese.—Manganese production in 1968 was the highest for the last 5 years and increased about 46 percent over the 1967 output. The significant producers were mines near Silivri in Thrace and the Cöplerköy mine near Erzincan. Most of the ore exported in 1967 came from the latter. Mining activities in the once thriving Eregli-Devrek region dwindled to near cessation in 1968.

Mercury.—Mercury production increased about 4 percent in 1968 over that of 1967; however, when compared with that of the last 5 years, 1968 output was about double that of 1964. With the new modern retorting facilities nearing completion in 1968, it appeared that Turkey will add 11,000 flasks to current annual capacity and elevate exports of this commodity to 20,000 to 25,000 flasks by year 1970.

One of the new facilities is located near Odemis at the Karaburun peninsula and is owned by a private mining company, Metaş Madencilik ve Ticaret Ltd. Skt. of Izmir. The capacity of the Odemis installation, at the first stage, would be 130 tons per day of ore averaging 0.27 percent mercury (equivalent to 2,500 flasks per year) and would be doubled in the later stages.

The other installation is at Ludik-Sizma near Konya where Etibank was developing two mercury properties formerly owned by private companies. At this location a rotary furnace will treat daily 170 tons of ore averaging 0.4 percent mercury which is an annual capacity of approximately 6,000 flasks.

NONMETALS

Barite.—The available figures on barite production in 1968 showed a 35.7-percent decrease below the peak production year of 1967. Exports in 1967 were a record high of 22,873 metric tons with the United States, the main customer, receiving 16,721 metric tons, followed by Libya and Greece. This new Turkish export commodity added about $235,000 to the foreign exchange earnings of the mineral industry in 1967.

Boron.—Even though the mine production of boron minerals dropped slightly in 1968 from the 1967 level, exports in 1968 showed an increase of 9 percent over 1967 levels. Etibank (public sector) remained the main producer, followed by Türk Boraks Madençilik, a subsidiary of Boron Consolidated Ltd., and Rasih ve Ihsan and Hasmettin Yakal, all private-sector producers.

According to the Ministry of Energy, the major borate producing areas in Turkey are located in Balikesir Province, Kutahya Province, Bursa Province, and Eskişehir Province, all in western Turkey.

Almost all borate exports are made through Bandirma port on the Sea of Marmara. Total value exports for 1968 was given at about $6.5 million. France, Italy, and the United States were listed as the principal importers.

Cement.—The 11-percent increase in cement production in 1968 did not meet domestic consumption and Turkey continued to import cement. The imports of cement in 1967 amounted to 178,458 metric tons, of which 137,159 tons came from the U.S.S.R.

Entering into production in the latter part of 1967 was the 400,000-metric-ton-per-year Trabzon plant and a new addition to the Afyon plant. Both are owned by Turkiye Cimento Sanayii T.A.S. (Turkish Cement Industries).

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According to official estimates of the planning organization, the completion of other expansions and new plants should raise cement production to over 5.5 million metric tons in 1970 and make Turkey self-sufficient in this commodity.

Fertilizer Materials.—Turkey's fertilizer industry output declined 6 percent during 1968, producing 24,674 metric tons less than in 1967. The construction of a fertilizer plant west of the Ataş refinery at Mersin under the joint ownership of Kuwait and Turkey continued in 1968 under the supervision of a Danish consulting firm. The Kuwait Petrochemical Co. has a one-third ownership valued at about $6 million. In addition, the Kuwaitis have loaned another $11 million to its Turkish partners which include the State-operated Seker Bank and the Iş Bank and the quasi-State agency, The Turkish Nitrate Industry. Furthermore, the Kuwaitis have agreed to supply ammonia over a 10-year period at $4 to $5 below the world market price. The plant is to open in mid-1970 with a 750,000-metric-ton production, the largest in Turkey. Its output will initially be marketed throughout Turkey and perhaps will satisfy the present shortages.

Table 5.—Turkey: Production of chemical fertilizer

(Thousand metric tons)

Commodity	1963	1964	1965	1966	1967
Ammonium nitrate	59	86	64	65	64
Ammonium sulfate	89	63	92	86	86
Superphosphate	175	152	221	222	205
Total [1]	322	301	377	374	360

[1] Data may not add to totals shown because of independent rounding.

New plans were being drawn up for phosphate fertilizer plants at Samsun on the Black Sea coast and at Elazig in eastern Anatolia.

Magnesite.—Production of crude magnesite in 1968 reached a new high with a 38-percent increase over the 1967 output. Most of this tonnage is now sintered in Turkey and thus, since there was little domestic consumption, exports are best measured in marketable products.

In 1967, Austria was the leading importer of both categories of magnesite—5,711 metric tons of crude ore and 12,300 tons of calcined magnesite.

In 1968 Continental Ore Co., the leading producer and exporter of sintered magnesite, apparently transferred one-third of its holdings in the Turkish subsidiary to Société Generale des Produits Refractories of France.

Sümerbank's chromite-magnesite refractory brick plant at Meran near Konya was completed in 1968. The plant is expected to produce 26,000 tons of sintered magnesite annually, portions of which will be used to manufacture 5,000 tons of magnesite brick, 4,500 tons of chrome-magnesite brick, and 5,400 tons of tar-bound magnesite.

Pyrite.—Overall production of pyrite in 1968 increased about 9 percent compared with the 1967 output. Exports of cupreous pyrite in 1967 increased 30 percent over the previous year's exports. Results of exploration carried on in 1966 and 1967 indicated that reserves of the Bakir Baba ore bodies were smaller than previously suggested. The new estimate is 588,300 metric tons, averaging 5.89 percent copper. This ore will be charged directly to the flash roasting furnace to be built at the Black Sea copper smelter in Samsun. Another block of 502,000 metric tons averages 2.2 percent copper which will be mined and shipped as cupreous pyrite.

Detailed information on the organization of the company which Etibank was attempting to organize in 1967 was not available by yearend.

Stone.—Marble production in 1968 reached 50,000 cubic meters which is an increase of about 66 percent over that of 1967. Exports in 1967, however, decreased 63 percent, indicating a greater demand for marble in the domestic market of Turkey. Exports of marble brought about $124,000 of foreign exchange to Turkey in 1967.

Sulfur.—Sulfur production from Etibank's Keçibolu operation decreased 4 percent from the record high of the previous year. Even though 1967 output was the highest in the last 10 years, it was considerably short of the production target of 30,000 tons set by the plant organization. The average ore grade in Keçibolu is about 65.14 percent.

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MINERAL FUELS

The primary energy resources used in Turkey at present can be classified in two categories—commercial energy sources such as coal, petroleum products, and hydropower, and noncommercial energy sources such as fuelwood, charcoal, and dried dung. More than half of Turkey's energy is met by noncommercial energy and the remainder is supplied partly by indigenous resources and partly by crude petroleum imports. In 1968, the percentage of consumption of various types of energy resources, given in coal equivalent values, was as follows: Bituminous coal, 14.8 percent; lignite, 11.4 percent; petroleum products, 31.4 percent; hydroelectric power, 4.9 percent; wood, 20.8 percent; and dried dung, 16.7 percent.

Coal (Bituminous).—Zonguldak remained the major producing area of bituminous coal in 1968. Run-of-mine production was given at 7.5 million tons. Private sector production of low-calorie, high-ash, subbituminous coal was 12,000 metric tons. Production by mines, 1965–67, is shown in the following tabulation:

	Thousand metric tons		
	1965	1966	1967
Public sector:			
Celik (Karadon)	1,670	1,848	1,941
Uzülmez	1,278	1,447	1,445
Kozlu	1,130	1,234	1,281
Kandilli (Armutçük)	316	351	364
Private sector:			
Diyarbakir (Hazro)	12	18	12
Total	4,401	4,893	5,043

Proven reserves of bituminous coal was given as 233 million metric tons in 1968 which includes all of the Zonguldak basin and Diyarbakir area.

Coke.—Production of coke increased 5 percent in 1968. Contributing to the 1968 total were the city plants in Ankara, Istanbul, and Izmir and the Karabuk and Eregli steel plants, with some contribution from the Zonguldak semicoke plant. According to the State Planning Organization, coke production by 1972 should reach 1.8 million tons, primarily aimed at metallurgical purposes, while liquefied petroleum gas should replace the present energy obtained from coke.

Lignite.—Only run-of-mine production data on lignite were available in 1968; however, it was estimated that salable lignite production was slightly higher than in 1967. The share of total energy consumption of Turkey contributed by lignite is increasing every year. According to the State Planning Organization, in 1950, 4.8 percent of the total energy consumption was met by lignite while in 1968 the contribution was 11.4 percent. It seems lignite eventually will be the main replacement fuel for wood and dung. A new discovery in 1967 near Elbistan in the Maraş Province drilled during 1968, has proven reserves of 1 billion metric tons. The Elbistan discovery, together with holdings of Turkiye Kömür Işletmeleri Kürümu (TKI), places possible reserves of lignite in Turkey in the vicinity of 4.2 billion metric tons.

Production of salable lignite by TKI and privately operated producers was as follows:

	Thousand metric tons		
	1965	1966	1967
Public sector:			
Tunçbilek	1,181	1,357	1,336
Soma	623	778	755
Degirmisaz	161	69	-----
Seyitomer	544	652	706
Dodurga (Çorum)	25	61	90
Saray (Thrace)	-----	1	2
Beypazari	-----	3	40
Subtotal	2,534	2,921	2,929
Total private sector	1,632	1,853	1,536
Total	4,166	4,774	4,465

Petroleum.—The importance of petroleum production among the primary energy sources of Turkey was indicated in 1968 by the 14-percent incerase over 1967 output. While petroleum products constituted 6.2 percent of the total energy consumption in 1950, they reached 31.2 percent in 1968. According to the State Planning Organization, at the end of the second 5-year plan (1968–73) the percentage increase is estimated to be as much as 37 percent.

Refinery products output in 1968 increased to a new high of approximately 45,629,000 barrels, an increase of 27 percent over 1967 production. Only Batman refinery processes domestic crude oil, whereas Ipraş and Ataş refineries use foreign oil for feed.

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More recently, the production of liquefied petroleum gas (LPG) has been increasing steadily to meet the fast-growing demand. Consumption of LPG has jumped from 46,922 metric tons in 1965 to an estimated 158,233 tons in 1968, and apparently will reach 422,000 tons by 1972. To meet this consumption, the Batman refinery at present produces 20,000 and Ataş refinery produces 53,000 tons of LPG; however, in the future it is proposed to add LPG producing units to the Izmir refinery.

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The Mineral Industry of the U.S.S.R.[1]

By V. V. Strishkov [2]

The U.S.S.R., with a centrally planned economy, maintained its position in 1968 as the world's second largest producer of industrial products. Compared with 1967 levels, production of electric power increased by 50 billion kilowatt-hours, oil by 21.3 million tons, gas by 11.8 billion cubic meters, pig iron by 4.0 million tons, steel by 4.3 million tons, finished rolled metal by 3.4 million tons, mineral fertilizers by 3.3 million tons, and cement by 2.7 million tons. There were also increases in the output of aluminum, gold, and platinum. Production of coal decreased by 1.2 million tons.

Practically all mineral commodity exports increased in 1968. Fuel exports were the largest and fastest growing commodity group in Soviet trade. The rate of growth of oil exports may increase despite rising home demand and some production and transportation difficulties. Despite the development of the mineral industry, the economy lacked many mineral raw materials required by Soviet consuming industries.

The expansion of the Soviet mineral industry was largely due to growing inputs of labor and capital rather than to advancing technology. It is estimated that 2 to 3 times more capital and labor in real terms were required in the U.S.S.R. than in the principal countries of the West to achieve a given increase in mineral output. The productivity of labor and equipment was much below planned levels. Practically all sectors of the mineral industry maintained greater numbers of production personnel than called for by plan targets. The coal industry, which produced 594 million tons of run-of-mine coal, employed 19,000 workers over the number envisaged in the planned output of 603.6 million tons. Because of shortages of mineral commodities, efforts were directed chiefly toward fulfilling quantitative goals, and less attention was paid to quality. Goals of the 1968 plan were not fulfilled in several mineral industry areas. The production of electric power, pig iron, steel, coal, gas, cement, and many other mineral commodities were below both industry requirements and 5-year-plan targets. The 4-percent increase in the output of fuel was the lowest reported during the last 8 years. Coal output remained virtually unchanged and the expansion of petroleum and natural gas output slowed down in both cases to the rate of 7 percent. The 1966–70, 5-year plan for the expansion of coal and natural gas output has apparently been shelved. The increases in the output of steel and rolled products—4.2 and 4.3 percent, respectively—were below those of 1967.

Labor turnover remained a serious problem at many mines and plants particularly in the north and northeast. Turnover of personnel in the nonferrous metals industry increased from 20.1 percent in 1967 to 20.6 percent in 1968. This was attributed mainly to the lag in building houses and in providing medical and public services, to low material incentives, and to the heavy manual work involved. Large numbers of women were employed in the mineral industry, some in underground work. More than half of the machinery employed in the mineral industry was idle. This largely related to the quality of the machines and the unsatisfactory supply of

[1] The statistical data used in this publication, with a few indicated exceptions, are taken from the sources published by the U.S.S.R.

[2] Mining engineer, Division of International Activities.

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spare parts and materials at the mines and plants. The number of machines under repair increased considerably, while the periods of repair also rose. The production of metallurgical and mining equipment has grown substantially, but the technical standards and the quality of equipment produced "do not always answer modern requirements."[3] Plants often preferred to manufacture old models rather than undertake new technology.[4]

According to the Economic Gazette:

> On the average we still lag behind a number of foreign nations in terms of labor productivity in the mining industry. This in large is to be explained by a lack of modern equipment particularly in auxiliary operations.[5]

In the current 1966–70, 5-year plan capital investments in the Soviet economy are scheduled at 310 billion rubles,[6] 47 percent more than in the 1961–65 period. Of these, around 11 billion rubles are being allocated for the ferrous industry and over 6 billion rubles for the nonferrous industry. The value of the fixed assets of the Soviet mineral industry is growing by about 12 to 15 percent annually. The ferrous industry comprised approximately one-tenth of the nation's assets. The return on capital dropped by 17.5 percent from the 1959–65 period and it declined by 1.3 percent in 1966.

The State plan for 1969 was approved by the Supreme Soviet December 13, 1968. The main goals set forth were the growth of heavy industry and steady development rates for the mineral industry. The volume of industrial production is to be increased by 7.3 percent in 1969 over that of 1968. It is planned to increase natural gas output by 8 percent, rolled ferrous products by 5.3 percent, mineral fertilizers by 8.3 percent, and cement by 5 percent. The 1969 plan envisages an increase of 6 percent over the 1968 total of investments in development of the Soviet economy. It is planned to increase the average monthly earnings of Soviet workers and employees in 1969 to 116.4 rubles, or 3.3 percent over those of 1968.

The level of Soviet industrial production in 1968 and that planned for 1969 follows in million metric tons unless otherwise specified:

Commodity	Production			1968		1969 Planned production
	1955	1960	1965	Planned production	Reported production	
Iron ore	71.9	r 105.9	153.4	r 177.0	176.6	186.7
Pig iron	33.8	46.8	66.2	79.0	78.8	88.4
Steel	45.8	65.8	91.0	107.3	106.5	112.6
Rolled metal	35.3	r 51.0	70.9	85.0	85.2	89.6
Steel pipes	3.5	5.8	9.0	r 11.5	11.2	11.5
Cement	22.5	45.5	72.4	r 89.3	87.5	92.0
Mineral fertilizers	9.7	13.9	31.3	42.2	43.4	46.5
Raw coal (bituminous, anthracite, and lignite)	r 389.9	r 509.6	577.7	603.6	594.0	595.3
Coke	43.6	56.2	67.5	71.9	71.3	74.1
Natural gas (billion cubic meters)	10.4	r 47.2	129.4	173.0	171.0	185.8
Peat, fuel	50.8	53.6	45.8	r 60.0	• 60.0	• 65.0
Petroleum crude	70.8	r 147.9	242.9	309.0	309.4	326.5
Power, electric (billion kilowatt-hours)	170.2	292.3	506.7	650.0	638.0	687.0

• Estimate. r Revised.

PRODUCTION

Since Soviet mineral statistics were not published in most cases, many of the data in the production tables were estimated, and represent, at best, an order of magnitude. The increase in Soviet mineral production in 1968 was largely due to additional inputs of capacity and labor rather than to productivity gains.

Reportedly, 70 elements were being produced in the U.S.S.R. in 1968. The Ukraine continued to provide more than one-third

[3] Pravda. Moscow, Mar. 19, 1968, p. 4.
[4] Izvestiya. Moscow, Mar. 19, 1968, p. 3.
[5] Ekonomicheskaya gazeta (Economic Gazette). Moscow, February 1968, No. 5, p. 27.
[6] Official exchange rate 1 ruble = $1.11. Approximate buying power of 1 ruble relative to prices in the United States for hard goods and food ranges from about 20 to 50 cents.

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of Soviet coal, about one-third of total gas, some 55 percent of iron ore, 50 percent of pig iron, more than 40 percent of steel and rolled metals, and nearly 50 percent of metallurgical equipment. Kazakhstan was the nation's leading producer of lead, chromite, and rare metals, and the second largest producer of copper and zinc.

Production of iron and steel was millions of tons below capacity. Blast-furnace charge was about 2 percent lower in iron content than that called for in the plan. As a result, the great majority of blast furnaces did not reach planned capacity. Of eight blast furnaces at the Krivorozhstal' plant none attained planned levels in 1968, operating at only 70 percent of established capacity. Almost one-half of Ukranian open-hearth furnaces employing the latest equipment did not reach rated capacity.[7]

[7] Pravda. Moscow, Mar. 14, 1968, p. 2.

Table 1.—U.S.S.R.: Estimated[1] production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Ores and concentrates:					
Bauxite, 26 to 52 percent alumina	4,300	4,700	4,800	5,000	5,000
Nepheline concentrate, 25 to 30 percent alumina	500	900	950	1,000	1,000
Alunite ore, 16 to 18 percent alumina	40	50	500	1,000	1,000
Metal, smelter:					
Primary	800	840	890	965	1,000
Secondary	80	85	90	100	100
Antimony, mine output, metal content metric tons	6,100	6,200	6,300	6,400	6,400
Arsenic, white (As_2O_3) do	6,500	6,800	6,900	7,000	7,000
Beryl, cobbed, 10 to 12 percent BeO do	1,000	1,000	1,100	1,200	1,200
Bismuth, mine output, metal content do	30	35	35	40	40
Cadmium, metal do	1,800	1,900	2,050	2,200	2,200
Chromite ore, 30 to 56 percent Cr_2O_3	1,180	1,270	1,450	1,570	1,650
Cobalt, mine output, metal content do	1,200	1,300	1,300	1,400	1,400
Copper:					
Ores, gross weight, 0.5 to 2 percent Cu	65,000	70,000	75,000	80,000	80,000
Blister:					
Primary	650	700	750	800	800
Secondary	140	145	150	160	160
Iron and steel:					
Iron ore, 55 to 63 percent Fe[2]	145,586	153,432	160,271	r 168,246	176,617
Iron ore sinter[3]	103,613	NA	115,662	123,185	128,235
Pellets	---	---	1,607	2,870	7,186
Pig iron and ferroalloys:[3]					
Pig iron for steelmaking	51,594	NA	59,832	64,147	67,792
Foundry pig iron	8,977	NA	8,979	9,308	9,588
Spiegeleisen	81	NA	93	91	75
Ferromanganese	916	NA	902	911	944
Other blast furnace ferroalloys	809	NA	458	355	389
Total	62,377	66,184	70,264	74,812	78,788
Steel:[3]					
Ingots	78,921	NA	90,492	95,653	99,741
Steel for casting	6,113	NA	6,415	6,582	6,791
Total	85,034	91,021	96,907	r 102,235	106,532
Semimanufactures:					
Heavy sections	16,747	NA	25,744	28,230	29,983
Light sections	5,730	NA			
Wire rods	4,635	NA	5,819	6,454	6,589
Pipe stock	3,777	NA	4,099	4,195	4,232
Tubes from ingots	1,121	NA	1,157	1,239	1,310
Plates and sheets:					
More than 5 millimeters thick	9,464	NA	8,374	8,729	9,232
Other	7,944	NA	11,225	11,636	12,181
Total plates and sheets	17,408	NA	19,599	20,365	21,413
Strip	4,507	NA	5,984	6,468	6,901
Railway track material	3,228	NA	3,274	3,276	3,370
Wheels, tires and axles	808	NA	787	831	829
Unspecified, for sale	407	NA	740	673	584
Other	123	NA	92	65	98
Total semimanufactures	58,491	61,600	67,295	71,796	75,309

See footnotes at end of table.

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Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS—Continued					
Iron and steel—Continued					
Selected end products:[4]					
Welded pipes and tubes	4,022	NA	5,496	r 5,974	6,412
Seamless pipes and tubes	4,102	NA	4,409	r 4,608	4,803
Total	8,124	9,000	9,905	r 10,582	11,215
Cold-rolled sheets	3,031	NA	3,862	4,081	4,208
Tinplate	406	NA	466	483	497
Galvanized sheets	303	NA	332	384	451
Electrical sheets	790	NA	862	898	921
Wire, plain	1,936	NA	2,422	2,649	2,778
Lead, metal:					
Primary	330	350	375	400	400
Secondary	70	70	75	80	80
Magnesium, metal including secondary	34	35	37	40	40
Manganese ore [2]	7,096	7,576	r 7,706	r 7,175	• 7,500
Mercury, metal, including secondary 76-pound flasks	35,000	40,000	40,000	45,000	45,000
Molybdenum, mine output, metal content metric tons	6,000	6,200	6,500	7,000	7,000
Nickel, metal, including secondary	80	85	90	100	100
Platinum thousand troy ounces	1,500	1,700	1,800	1,900	2,000
Silver, metal, including secondary do	29,000	31,000	33,000	35,000	35,000
Tin, metal:					
Primary long tons	22,000	23,000	24,000	25,000	26,000
Secondary do	7,000	7,000	8,000	8,000	8,000
Titanium, metal	6	7	8	10	11
Tungsten concentrates, contained tungsten metric tons	5,000	5,200	5,700	6,200	6,200
Zinc:					
Recoverable metal content of domestic ores	430	470	500	535	540
Metal:					
Primary	445	480	510	540	540
Secondary	50	55	55	60	60
NONMETALS					
Asbestos	735	745	755	769	800
Barite	220	230	250	260	260
Boron, materials and compounds, B_2O_3 content	64	65	67	68	69
Cement [2]	64,984	72,388	r 80,013	r 84,809	87,500
Kaolin (including china clay)	1,500	1,600	1,600	1,700	1,700
Corundum metric tons	4,000	5,000	5,000	5,000	6,000
Diamond:					
Gem thousand carats	800	1,000	1,200	1,400	1,400
Industrial do	3,200	4,000	4,800	5,600	5,600
Total do	4,000	5,000	6,000	7,000	7,000
Diatomite	320	330	350	360	360
Feldspar	220	230	240	240	240
Fertilizer materials:					
Crude:					
Nitrogen compounds, N content equivalent [2]	r 2,099	r 2,712	r 3,188	r 3,753	• 4,100
Phosphate:					
Apatite:					
Ore 17.7 percent P_2O_5	15,400	18,200	19,300	21,200	[2] 24,000
Concentrate, 39.4 percent [2] P_2O_5	6,380	7,550	8,000	8,800	9,700
Sedimentary rock:					
Ore, 13 percent P_2O_5	8,700	[2] 12,100	13,500	15,000	16,000
Concentrate, 19 to 25 percent P_2O_5	4,350	6,050	6,750	7,500	8,000
Potash, K_2O equivalent [2]	r 1,894	r 2,368	r 2,626	r 2,868	• 3,150
Manufactured:[2]					
Nitrogenous, bulk	10,222	13,217	15,534	18,305	• 20,300
Phosphatic, bulk	7,522	8,550	9,499	9,984	• 10,500
Potassic bulk	4,553	5,691	6,311	6,894	• 7,400
Phosphatic meal	3,155	3,690	4,417	4,776	• 5,200
Others	110	105	105	124	----------
Total	25,562	31,253	35,866	r 40,083	• 43,400
Fluorspar	300	350	350	380	380
Graphite	60	60	65	65	70
Gypsum [2]	4,203	4,344	r 4,495	r 4,691	• 4,850

See footnotes at end of table.

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Table 1.—U.S.S.R.: Estimated [1] production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS—Continued					
Lime, dead burned [2]	16,198	r 17,714	r 18,873	r 19,651	• 20,000
Magnesite	2,800	2,900	2,900	3,000	3,000
Mica	32	33	34	35	36
Pyrite:					
Gross weight	3,200	3,300	3,300	3,500	3,500
Sulfur content	1,700	1,750	1,750	1,850	1,850
Refractories: [3]					
Shamotte	5,695	5,790	r 5,977	r 6,075	• 6,200
Dinas (quartzite-lime)	629	637	r 641	r 637	• 650
Magnesite and chrome magnesite	1,313	1,372	r 1,401	r 1,424	• 1,500
Magnesite powder	1,220	1,265	r 1,362	r 1,320	• 1,350
Total	8,857	9,064	r 9,381	r 9,456	• 9,700
Salt, all types [2]	10,100	9,500	r 9,300	r 10,600	• 11,000
Sulfur (excluding sulfur content of pyrite)	1,350	1,430	1,430	1,500	1,500
Talc	350	360	360	370	370
MINERAL FUELS AND RELATED MATERIALS					
Coal: [5]					
Brown [2]	145,127	149,850	146,434	r 143,815	146,000
Hard:					
Coking [2]	133,617	138,959	r 142,549	r 147,623	155,000
Anthracite [2]	74,898	76,467	76,775	r 77,139	77,500
Undifferentiated	200,355	212,455	219,846	r 226,624	215,500
Total hard coal	408,870	427,881	439,170	451,386	448,000
Total [2]	553,997	577,731	585,604	r 595,201	594,000
Coke, oven and beehive [2]	66,282	67,462	68,493	r 69,897	71,500
Crude oil [2]	223,603	242,888	265,125	r 288,068	309,400
Fuel briquets	r 6,500	6,518	6,582	r 6,787	7,000
Oil shale [2]	20,233	21,259	21,374	r 21,601	21,700
Peat, agricultural use	110,000	130,000	130,000	130,000	130,000
Peat, fuel use [2]	59,500	46,000	• 65,400	65,000	60,000
Natural gas [2] billion cubic feet	3,892	4,570	5,110	5,601	6,039
Electric power [2] billion kilowatt-hours	459	507	545	r 588	688

• Estimate. r Revised. NA Not available.

[1] Estimate except where noted.

[2] Reported in Soviet sources except for estimates in column 1968, where indicated.

[3] Data for 1964, United Nations Quarterly Bulletin of Steel Statistics for Europe, v. 16, No. 1, 1965, p. A–23; for 1966, v. 18, No. 3, 1967, p. A–23; for 1967, v. 19, No. 1, 1968, p. A–23; for 1968, No. 2, 1969, p. A–23.

[4] Items listed under this heading are produced from semimanufactures listed above and possibly also from imported material. Therefore, these data are not additive to the total of semimanufactures listed.

[5] Run-of-mine coal; the average ash content of the coal shipped from the mines was 19.6 percent and average calorific value was a little more than 5,000 kilocalories per kilogram in 1968.

TRADE

Soviet foreign trade is oriented toward the importation of needed production machinery and equipment, including complete industrial plants. Exports of minerals produce foreign exchange to help pay for imports even though most minerals exported could be consumed within the country. Ministry of Foreign Trade plans the volume and value of exports and imports which are included in the national 5-year plans.

Tables 2 and 3 are derived from official statistics of the Ministry of Foreign Trade for 1967 and partially for 1968. Official figures by country for 1968 are not yet available, but are expected to follow the same general pattern.

The value of total Soviet trade expanded from 16.4 billion rubles in 1967 to 18.0 billion in 1968. Imports and exports were each 10 percent higher in 1968 than in 1967. Exports from the Soviet Union were valued at 9,571 million rubles, including 6,421 million in trade with Communist countries. The value of imports amounted to 8,469 million rubles, of which 5,732 million originated with Communist countries.

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Table 2.—U.S.S.R.: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1967
METALS			
Aluminum:			
Ingots and equivalent primary forms	253,100	287,600	East Germany 92,500; Czechoslovakia 28,900.
Semimanufactures, including those of duraluminum.	60,400	79,500	Czechoslovakia 12,283; East Germany 12,100.
Antimony, primary forms	1,300	800	Japan 400; Bulgaria 326; Netherlands 200.
Cadmium, primary forms	500	700	East Germany 230; Czechoslovakia 136.
Chromite (48 to 56 percent Cr_2O_3)	1,030,000	1,048,000	United States 280,000; Japan 165,000; West Germany 150,000; Sweden 110,000; France 100,000.
Cobalt, primary forms	100	NA	NA.
Copper:			
Ingots equivalent primary forms:			
Unalloyed	94,000	109,300	East Germany 41,600; Czechoslovakia 28,400.
Alloyed (bronze)	2,600	5,700	East Germany 2,200.
Semimanufactures:			
Unalloyed	5,800	7,900	Cuba 2,700; Rumania 871; Czechoslovakia 592.
Alloyed (copper-zinc)	3,600	3,800	Cuba 1,100; Bulgaria 668.
Ilmenite	10,300	NA	All to Italy.
Iron and steel:			
Iron ore—thousand tons	28,685	32,201	Czechoslovakia 8,665; Poland 8,584.
Pig iron—do	4,432	4,522	Japan 1,288; East Germany 717; Poland 700.
Ferrous scrap—do	678	664	Japan 210; East Germany 206; Finland 101.
Ferroalloys:			
Ferrotungsten	NA	NA	
Ferrosilicon	100,400	111,800	Rumania 65,500; Czechoslovakia 46,600; Netherlands 30,400; United Kingdom 27,600.
Ferromanganese	87,000	97,200	
Ferrochromium	31,000	33,300	
Ferrovanadium	1,900	2,000	
Not specified	68,700	68,100	
Total	289,000	312,400	
Semimanufactures:			
Rolled products, excluding pipes, thousand tons	5,160	5,472	East Germany 1,976; Rumania 690.
Steel pipes—do	282	294	East Germany 121; Bulgaria 49.
Lead, ingots and equivalent primary forms	86,900	90,900	East Germany 41,600; Czechoslovakia 24,200; Hungary 9,500.
Magnesium, primary forms	8,600	14,500	East Germany 1,807; Netherlands 1,700.
Manganese ore:			
Metallurgical grade	1,250,000	1,150,000	Poland 304,000; East Germany 216,000; Czechoslovakia 186,000.
Battery and chemical	17,000	19,000	Netherlands 9,500; East Germany 2,400.
Mercury—76-pound flasks	610	NA	NA.
Nickel	6,600	NA	All to United Kingdom.
Tin, primary forms—long tons	6	NA	NA.
Zinc, ingots and equivalent primary forms	74,100	78,700	East Germany 37,500; Czechoslovakia 16,600.
NONMETALS			
Abrasives, hard alloys	68	89	Bulgaria 17; Hungary 11.
Asbestos	285,200	303,600	France 38,900; East Germany 36,550.
Cement—thousand tons	2,279	2,641	Hungary 377; Cuba 257.
Cryolite	3,900	5,400	Poland 1,700; Hungary 1,000.
Fertilizers and fertilizer raw material			
Apatite ore	90,400	60,500	Czechoslovakia 54,600.
Apatite concentrates, 38.5 to 39.4 percent P_2O_5, thousand tons	4,510	5,107	East Germany 915; West Germany 705.
Superphosphate, not less than 18.7 percent P_2O_5.	378,200	445,600	Cuba 115,800; Hungary 112,000; Bulgaria 53,100.
Ammonium nitrate	127,500	197,900	Cuba 116,300.
Ammonium sulfate	693,800	749,100	Cuba 300,300; India 122,600.
Potassium salts, KCl 58 to 62 percent K_2O equivalent.	1,365,300	1,721,500	Japan 291,000; Yugoslavia 130,800.
Graphite	9,500	10,200	East Germany 2,800; Bulgaria 2,000; Poland 1,800.
Gypsum	20,100	NA	All to Finland.
Kaolin	5,200	NA	NA.

See footnotes at end of table.

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Table 2.—U.S.S.R.: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1967
NONMETALS—Continued			
Pyrite—thousand tons	1,611	1,532	Italy 793; East Germany 247.
Refractories:			
Clay, fire resistant	17,200	23,800	Poland 10,500; Hungary 6,600.
Magnesite powder	15,500	NA	Rumania 9,900; Japan 5,600.
Other	80,600	118,200	Bulgaria 31,400; Poland 12,200.
Salt	270,100	312,600	Czechoslovakia 90,500; Hungary 49,100; Finland 30,700.
Sulfur	281,600	291,200	Cuba 135,500; Hungary 63,000; Czechoslovakia 41,100.
Sulfuric acid	159,100	182,500	Hungary 79,700; Czechoslovakia 29,600.
Talc	16,700	NA	All to Japan.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	29,033	28,400	East Germany 7,500; Czechoslovakia 5,200; Hungary 4,079.
Coal:			
Anthracite—thousand tons	2,979	3,197	France 1,396; Italy 300.
Bituminous—do	19,248	17,939	East Germany 4,945; Bulgaria 3,321; Czechoslovakia 2,154.
Other	85	113	All to Czechoslovakia.
Total—do	22,312	21,249	
Coke—do	3,694	3,824	East Germany 1,275; Finland 610; Hungary 592; Rumania 551.
Gas, natural—million cubic meters	1,290	1,729	Poland 1,025.
Petroleum:			
Crude—thousand tons	54,117	59,216	Italy 10,576; Czechoslovakia 7,425; East Germany 6,137.
Refinery products:			
Gasoline—thousand tons	3,276	3,352	Poland 778; West Germany 473; Italy 379.
Kerosine—do	1,181	1,321	India 469; Czechoslovakia 250; Ceylon 161.
Gas, diesel oil—do	8,616	10,089	Finland 1,731; West Germany 905.
Residual fuel oil—do	11,166	11,682	Sweden 3,074; Bulgaria 1,185.
Lubricants—do	267	299	Cuba 66; Bulgaria 56; North Korea 26.
Bitumen—do	33	38	Bulgaria 28.
Paraffin—do	25	24	Poland 7; Bulgaria 3.
Unidentified—do	128	194	All to Communist countries.
Total—do	24,692	26,999	
Power, electric—million kilowatt hours	1,802	2,470	Hungary 1,422; Poland 273.

NA Not available.

Sources: 1. Vneshnyaya torgovlya SSSR za 1967 god (Foreign Trade of the U.S.S.R. for 1967 Year), Moscow 1968, 312 pages. 2. Vneshnyaya torgovlya. Moscow, No. 8, August 1969, pp. 49–59.

Mineral industry products reportedly accounted for about 39 percent of the value of all officially recorded exports in both 1967 and 1968. The Soviet Union remained a significant exporter of mineral fuels, manganese, iron and chromite ores, steel ingots, and ferroalloys, aluminum, asbestos, apatite concentrate, potassium salts, and sulfur. Fuel and power exports represented 16 percent of the value of all exports in 1968 and exports of crude oil in 1968 were 3.3 times those in 1960. Kazakhstan accounted for all Soviet exports of chromite, over 80 percent of lead exports, and two-thirds of total exports of copper, cadmium, and zinc.

Mineral commodities imports were about 13 percent of all officially recorded imports in 1967 and 1968. The Soviet Union was a net importer of nonferrous semimanufactures, steel pipe, bauxite, alumina, tin, barite, fluorspar, talc, mica, and some other mineral commodities.

Official foreign trade statistics do not include exports of precious metals, but they are estimated to be one of the largest commodity groups by value. The value of known Soviet exports of these metals, as measured by the recorded imports of other countries, has been consistently high, notwithstanding appreciable annual fluctuations. There has been a steady increase in the exportation of cut diamonds.

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Table 3.—U.S.S.R.: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	1,076,700	NA	Yugoslavia 646,600; Greece 430,100.
Alumina	167,500	387,000	Hungary 89,400; United States 58,200; Greece 21,900.
Semimanufactures, including those of duraluminum.	2,300	2,200	NA.
Cadmium, primary forms	220	235	Poland 171.
Copper: Ingots and equivalent primary forms:			
Unalloyed	1,400	9,400	NA.
Semimanufactures	5,600	6,700	All from Yugoslavia.
Iron and steel:			
Pig iron—thousand tons	154	63	Finland 98.8; North Korea 55.
Ferroalloys—do	7	9	North Korea 1.2.
Rolled products, excluding pipes—do	910	1,362	West Germany 281; Austria 113; Rumania 95.
Steel pipes—do	583	765	Rumania 205; West Germany 87; Japan 73.
Lead:			
Ore	39,400	NA	All from Iran.
Ingots and equivalent primary forms	32,300	39,100	North Korea 17,000; Yugoslavia 11,900; Bulgaria 3,400.
Mercury—76-pound flasks	3,900	3,900	Yugoslavia 2,900; Mainland China 1,000.
Tin, primary forms—long tons	5,700	7,100	United Kingdom 3,900; Malaysia 1,700.
Tungsten, concentrate	600	NA	All from mainland China.
Zinc:			
Ore	20,000	NA	All from Iran.
Concentrate	2,300	NA	All from North Korea.
Dust	2,000	2,200	All from Poland.
Ingots and equivalent primary forms	29,700	36,400	Poland 19,400; North Korea 7,700.
Rolled products	700	800	All from Poland.
Alloys	4,000	3,900	Do.
NONMETALS			
Barite	143,100	180,000	North Korea 69,000; Bulgaria 28,100; Yugoslavia 25,300.
Cement—thousand tons	256	296	All from North Korea.
Fluorspar	84,800	102,000	Mongolia 46,100; mainland China 38,300.
Mica	155	160	All from India.
Refractories, magnesite powder	158,900	211,400	All from North Korea.
Sulfur	46,500	9,400	Undisclosed.
Talc	57,200	50,800	North Korea 27,400; mainland China 17,600; Bulgaria 12,200.
MINERAL FUELS AND RELATED MATERIALS			
Coal, bituminous—thousand tons	7,800	6,900	Poland 7,770.
Coke—do	685	658	All from Poland.
Petroleum refinery products:			
Gasoline—do	753	694	Rumania 445; East Germany 286.
Kerosine—do	12	7	Rumania 11.
Gas/diesel oil—do	242	186	Rumania 152.
Residual fuel oil—do	161	82	Rumania 11.
Lubricants—do	138	96	Rumania 121; Hungary 13.
Bitumen—do	26	22	All from Rumania.
Paraffin—do	8	6	Do.
Unidentified—do	19	22	Do.
Total—do	1,359	1,065	Rumania 777; East Germany 272.
Carbon black	3,500	1,700	Rumania 2,700; East Germany 500.

NA Not available.

Sources: Vneshnyaya torgovlya SSSR za 1967 god (Foreign Trade of the U.S.S.R. for 1967). Moscow, 1968 pp. 312. Vneshnyaya torgovlya. Moscow, No. 9, September 1969, pp. 51–60.

The proportion of all Soviet trade conducted with Communist countries declined slightly from 68 percent in 1967 to 67 percent in 1968. East Germany, Czechoslovakia, Poland, Bulgaria, Hungary, and Rumania retained their positions as the Soviet Union's most important foreign trade partners, in that order. European Communist countries accounted for 10.4 billion rubles of the total Soviet trade turnover of 18.0 billion rubles. Trade with Yugoslavia declined from 462 million rubles in 1967 to 456 million in 1968.

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Soviet mineral exports are an essential factor in the economics of the CMEA countries.[8] Rumania is the only other CMEA country producing significant quantities of petroleum—about 4.3 percent of the Soviet level in 1968. All others are heavily dependent upon liquid fuel imports to supply their industrial needs. Soviet deliveries covered one-third of the import requirements of the European Communist countries for machinery and equipment; almost 100 percent in pig iron; more than 95 percent in crude oil; over 80 percent in iron ore and aluminum; and 75 percent of requirements for petroleum products and phosphorus fertilizers in 1968. The U.S.S.R. purchased almost one-half of the total exports of machinery and equipment of the CMEA countries, primarily from East Germany, Czechoslovakia, and Rumania. Soviet trade with mainland China continued to decline.

The United Kingdom had the largest trade with the Soviet Union of any non-Communist country, with a total trade of 576 million rubles in 1968. The United Kingdom was followed by Japan (519), Finland (459), Italy (397), West Germany (394), France (388), the United Arab Republic (332), and the Netherlands (154). The United Kingdom is a traditional importer of Soviet nonferrous metals, manganese ore, and apatite concentrate.

The plans for 1969 and 1970 indicate an expansion of Soviet trade with Western developed countries. Agreements on economic and scientific-technical cooperation have been concluded with France, Italy, and Finland.

The Soviet trade turnover with the developing countries has grown through the expansion of economic and technical assistance to India, the United Arab Republic, Syria, Algeria, Pakistan, and also to countries bordering on the Soviet Union—Afghanistan, Turkey, and Iran. Agreements have been concluded with Afghanistan and Iran providing for the delivery of natural gas to the Soviet Union, in return for economic and technical assistance.

The Soviet Union imported 206.7 million cubic meters of natural gas from Afghanistan valued at 1,107,000 rubles in 1967.

The Soviet Union has concluded agreements for economic and technical cooperation with 35 Asian, African, and Latin American countries. The main items exported by the Soviet Union to Africa were machinery and equipment, petroleum products, ferrous metals, rolled products, and cement. In 1968 the volume of trade between the U.S.S.R. and the Latin America countries reached 1,036 million rubles with 78.5 percent of the trade accounted for by Cuba.

Soviet mineral trade in recent years has been growing at a more rapid rate than world mineral trade and probably will continue to expand. Soviet plans schedule substantial increases in foreign trade. In the U.S.S.R., reported production costs are not the major factor in determining the selling price of a commodity in the country or to the free world. The Soviet system permits the establishment of selling prices at any level believed desirable to meet economic requirements.

COMMODITY REVIEW

METALS

Aluminum.—The Soviet Union, second only to the United States in aluminum production, operated 13 primary reduction plants with a total probable annual capacity (January 1, 1969) of 1.45 million tons. In 1968, the U.S.S.R. produced an estimated 1 million tons of primary aluminum. Net aluminum consumption amounted to about 850,000 tons in 1968, a per capita use of about 3.5 kilograms—far below most West European countries.

The production of metal more than doubled during the 7-year plan 1959–65. Under the present 5-year plan (1966–70) aluminum output in 1970 is scheduled to be 1.9 to 2.1 times the 1965 level. It is planned to make Siberia and Kazakhstan the main centers of aluminum production, namely at Krasnoyarsk, Irkutsk, and Bratsk in Eastern Siberia, Novo-Kuznetsk (Kemerovo Oblast') in Western Siberia; and Pavlodar in Kazakhstan.

The third potline of the Krasnoyarsk aluminum plant, largest in the country, went into operation in December. The

[8] CMEA (CEMA)—Council for Mutual Economic Assistance—comprising the following countries: Bulgaria, Czechoslovakia, East Germany, Hungary, Mongolia, Poland, Rumania, and U.S.S.R.

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plant's two units operated at about 80 percent of capacity, and construction was started on an aluminum rolling mill. It was planned to double aluminum at the Bratsk aluminum plant in 1970 as compared with that of 1968. The plant's second potline went into operation at the end of December. The Irkutsk (Shelekhov) aluminum plant fulfilled its planned 1968 production goals. A rolling mill was under construction at this plant. Remodeling of the pots was being carried out at the Sumgait aluminum plant, and by the end of 1969 a total of 168 pots are to be renovated. A new aluminum plant was also being built at Regar in Tadzhikistan, with a new completion date for the first potline set for 1972, and completion of the entire plant scheduled for 1975. During the initial period of operation of the plant, the raw material will probably be brought from Azerbaydzhan.

India and the Soviet Union have agreed to build an aluminum complex at Korba in Central India. The project will produce 110,000 tons of aluminum and 55,000 tons of semimanufactured products annually.

Aluminum production quotas were not reached in either the 7-year plan or the 1966–68 plans primarily due to design defects at the Achinsk, Kirovabad, and Pavlodar alumina plants, the Turgay bauxite and Kiya-Shaltyrsk nepheline open pits, and the Severo-Ural'sk underground bauxite mines.

A number of alimina and aluminum plants which were built during the 7-year plan according to the design of the All-Union Aluminum-Magnesium Institute (V.A.M.I.) had to be modified subsequently.

In 1968, primary attention was being paid to improving the raw material base and to erecting alumina plants to overcome the gap between aluminum electrolysis capacity and alumina production capacity. Serious deficits of alumina in the U.S.S.R. seem probable in the next few years, pending development of the Siberian nepheline-based raw materials industry.

The Achinsk alumina plant in Western Siberia, which is to provide raw material for the Krasnoyarsk aluminum plant, has been under construction since 1955. Previous start up dates for the first line production were canceled and a new date has been fixed for 1969. Delay in starting this may slow the development of aluminum production based on water power from the Angara and Yenisey Rivers.

Bauxite was the main source of alumina in the U.S.S.R., although the grade is frequently low and transportation often presents a problem. Supplies were insufficient both as to quantity and quality and 1,244,000 tons of high-grade bauxite and alumina were imported from Yugoslavia, Greece, Hungary, and the United States in 1967. It is planned to import about 1.5 million tons of bauxite and alumina in 1969. Hungary under existing agreements will supply 160,000 tons of alumina to the Soviet Union in exchange for 55,000 tons of aluminum in 1969.

The production of bauxite in the Turgay, Kazakhstan only reached 60 percent of the planned quotas in 1968, and the quality of bauxite shipped to the Pavlodar alumina plant which was already approaching planned capacity was reportedly poor. Development of the Arkalyk bauxite open pit progressed; one additional ESH–15–90 excavator began operating there in October. Special exploration of the new Ayat bauxite deposit began in north Kazakhstan, where dozens of new boreholes were being drilled. The opening of three new underground mines in the northern Urals progressed slowly. Development began on a major bauxite open pit near Savinsk settlement on the banks of the Onega River in Archangel Oblast'. The first stage is to be completed in 1973. A promising new bauxite deposit was found near Voy-Vozh in the Komi A.S.S.R.

The principal facilities for production of alumina from nepheline are in the northern part of the European U.S.S.R. and are based on large reserves of nepheline on the Kola Peninsula. Other nepheline-based facilities are located in Siberia. Ore for the Achinsk alumina plant is to come from the Belogorsk nepheline open pit on the border of Krasnoyarsk Kray and Kemerovo Oblast', which was under construction in 1968. The Razdan mining and chemical combine in Armenia, which was under construction, is to supply nepheline raw materials to the Sumgait aluminum plant.

Deposits of alunite were being exploited in Azerbaydzhan, with the Zaglik open pit as the principal producer. At the Kirovabad alumina plant alunite was processed into alumina, but the plant did not reach its planned production due to the installation of equipment which had not been fully tested.

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The fourth section of Pavlodar alumina plant No. 1 was completed in April. The plant was the largest shipper of alumina in the U.S.S.R. in 1968. The fifth section (the first section of Pavlodar alumina plant No. 2) was under construction. The overall cost of the Pavlodar alumina plant increased from 49.9 million rubles in 1965 to 119.2 million in 1968.

Antimony.—The Kadamzhay combine in the Kirgiz S.S.R., remained the principal antimony center of the U.S.S.R., whose integrated facilities produced most of the country's refined products. In 1968, the combine exported antimony to 45 foreign countries, including its first shipment to Cuba. Compared with that in 1967, output of metal at the combine increased by a few percent. Installation of a new furnace planned to increase metal production by 20 percent was began in 1968. At the Zapadnaya mine of the combine a new shop producing antimony trioxide was commissioned and the smelting shop was renovated.

An antimony ore deposit associated with gold was discovered at Sarylakh in Yakut A.S.S.R. The Sarylakh antimony ore deposit is located near the North Pole. It is reportedly the northernmost antimony deposit in the world. Kirgiz specialists from the Kadamzhay combine were aiding in its development in 1968.

Chromium.—With an estimated output of 1.65 million tons, the U.S.S.R. was the leading world chrome ore producer and exporter in 1968. The Soviet Union's deposits of chromium ores are situated in the Western Kazakhstan and in the Ural Mountains.

The Donskoye mining administration at Khrom-Tau in Aktyubinsk Oblast' Western Kazakhstan which produced over 90 percent of the Soviet output, is the only supplier of high-quality ore in the U.S.S.R. Deposits of chromium ores in the Ural Mountains have a low chromium oxide content (20 to 40 percent), as well as a low Cr_2O_3:FeO ratio, for which reason they are mostly used in the chemical and refractory industries.

The U.S.S.R. increased chromite exports by 81 percent from 1963 to 1967 (567,000 to 1,030,000 tons).

Exports of chromium ore from the U.S.S.R. by country of destination for 1967 totaled 1,030,000 tons destinated as follows in thousand metric tons:

United States	Japan	France	West Germany	Sweden	Poland	Italy	Czechoslovakia	Other [1]
280	165	100	150	110	75	52	45	58

[1] Of which 22,000 tons to East Germany and 11,000 tons to Hungary.

Copper.—The Soviet Union produced an estimated 800,000 tons of primary copper in 1968. The copper production schedules are being pushed rapidly. According to the present 5-year plan, 1966–70, Soviet copper output should be increased by 60 to 70 percent. This would indicate a probable planned level of 1.1 to 1.2 million tons of primary copper by 1970; the estimated level for this year is 1 million tons. It is estimated that Soviet primary copper output may reach 1.4 million tons by 1975 and 1.9 million by 1980. It is reasonable to assume that the country will meet its own copper requirements and some "surpluses" for regular export trade outside the Soviet Block seem likely.

The gross copper ore reserves of the U.S.S.R. in 1968 were estimated at 35 million tons of contained metal. The cutoff percentage for copper ores varied over a wide range from 0.4 percent at the Kounrad open pit, to 1 percent Cu at underground mines in the Urals. About 75 percent of primary copper output in 1968 came from open pits.

The Urals was the main center of Soviet copper production in 1968. In January, an open pit and the first stage of the concentrating plant were commissioned at the Uchaly mining and concentrating combine in Bashkir, A.S.S.R., the second stage of the concentrating plant was under construction.

Kazakhstan contains over half of total Soviet copper reserves and was the second center of copper output. Kazakh copper production is to be increased considerably by the development of the Dzhezkazgan, Nikolayevsk, Sayak, and other deposits.

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Armenia occupied third place in the copper production in 1968. New production facilities were commissioned at the Kafan copper mining and concentrating combine.

Iron Ore.—The Soviet iron ore industry operated 66 underground mines and 58 open pits with a total capacity of about 200 million tons of usable ore in 1968. About 78 percent of ore production was from open pits, nearly half of which came from six pits, each producing over 10 million tons annually. Half of the open pits required hard rock mining, and the overall average overburden to ore ratio was about 3.5 to 1.

Production of usable ore was 176.6 million tons, an increase of 8.4 million tons over that in 1967. Direct shipping ore averaged 54 to 55 percent and concentrates averaged about 61 percent iron in 1968. The average grade of all ore mined (crude and direct shipping) was about 41 percent. Facilities for mining 25 million tons of crude ore at the Korshunov, Kachkanar, Southern, Northern, and Ingulets Mining and Concentrating Combines (GOK's), at the Kursk Magnetic Anomaly (KMA), the Urals and other regions were put into operation in 1968, compared with a planned addition of 32 million tons. The target for 1969 is 38.2 million tons of crude iron ore.

A new pellet plant at the Central Mining and Concentrating Combine (TsGOK) in the Krivoy Rog basin, and the existing plants at the Sokolovsk-Sarbaysk GOK raised total pellet production to 7.2 million tons in 1968, compared with 2.9 million in 1967. Construction of the fourth iron ore pellet plant with a capacity of 8 million tons annually began at the Krivoy Rog Northern GOK. The Soviet target of new capacity for 1969 is 4.2 million tons of sinter.

The current and fixed assets of the Soviet iron ore industry totaled 2,897 million rubles at the beginning of 1967. Between 1960 and 1967 output of usable ore per ruble of assets declined about 40 percent.

Usable ore production is slated to rise to 186.7 million tons in 1969; estimated levels for 1970, 1975, and 1980 are 197 million, 242 million, and 287 million tons, respectively.

Planned development of new capacities for the production of iron ore and concentrates during 1970–80, according to Soviet data, is shown in table 4.

As of January 1, 1968, mineable iron ore reserves in categories $A+B+C_1+C_2$ (proved, probable, and possible) in the U.S.S.R., totaled 111,400 million tons containing an average of 34.8 percent iron. The relative importance of the major regions is as follows (in percentages):

Ukraine	31.0
European Center	24.4
Urals	15.7
Kazakhstan	15.0
Siberia	7.4
North-West	3.0
Soviet Far East	2.5
Other	1.0

Of total reserves, those in categories A plus B plus C_1 were 58,800 million tons with an average iron ore content of 38.4 percent, including 10,300 million tons of ore not requiring dressing with an iron content of more than 55 percent, and 34,800 million tons of easily dressed iron ores. Estimated proved reserves of iron ore were 6,000 million metric tons in about 120 deposits. Mainly because of the shortage of storage facilities, there was a decline in the quantity of ore blended during the past few years at ore mining and metallurgical enterprises. As a result some blast furnaces were supplied with charging stock of unbalanced composition. About 45 million tons of Krivoy Rog iron ore containing 55.1 percent iron, delivered to metallurgical plants was not concentrated.[9] Because of the shortage of ore, the charge fed to Ukranian blast furnaces had a fines content of up to 20 percent.[10]

The Ukraine produced about 55 percent of the nation's iron ore in 1968 and the Krivoy Rog basin accounted for 95 percent of all ore produced in the Ukraine. Underground mines and open pits as well as five concentrating plants were operating in the region. The average iron content of mine-run ore was 33.86 percent for taconites and 55.1 percent for hematites. The recovery of iron from taconites in concentrate ranged from 63.6 to 79 percent.

The second and third sections of the Southern GOK were put into operation in 1968. Planned annual capacity is 15.2 million tons of concentrate. The first stage of the Annov open pit in the Krivoy Rog

[9] Pravda Ukrainy (Truth of the Ukraine). June 19, 1969, p. 2.
[10] Komsomol'skaya pravda. June 7, 1968, p. 2.

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Table 4.—U.S.S.R.: Additional crude iron and concentrating capacities in 1971–80

(Million metric tons)

	GOK (Mining and Concentrating Combine)	Construction to begin	Additional new capacities				Total new capacities by yearend 1980	
			1970–75		1976–80			
			Crude ore	Concentrate	Crude ore	Concentrate	Crude ore	Concentrate
	A. EUROPEAN CENTER							
1	Mikhaylov GOK (Stage 2)	1971	23.0	9.2	-------	-------	23.0	9.2
2	Lebedinsk GOK (Stage 2)	1971	23.0	9.2	-------	-------	23.0	9.2
3	GOK No. 1 (Stoylensk)	1972	10.0	4.0	10.0	4.0	20.0	8.0
4	GOK No. 2 (Chernyanka)	1972	15.0	6.0	15.0	6.0	30.0	12.0
5	GOK No. 3	1973	2.0	1.0	3.0	1.5	5.0	2.5
	B. UKRAINE							
6	Oxidized ores plant	1973	3.0	1.5	7.0	3.5	10.0	5.0
7	Novo Krivoy Rog GOK	1971	11.0	5.5	-------	-------	11.0	5.5
8	Ingulets GOK	1971	4.0	1.2	-------	-------	4.0	1.2
9	Central GOK	1971	5.0	1.6	-------	-------	5.0	1.6
10	Ann GOK	1972	15.0	5.0	15.0	5.0	30.0	10.0
11	Valyav GOK	1972	15.0	6.5	15.0	6.5	30.0	13.0
12	Azov GOK	1973	10.0	3.1	-------	-------	10.0	3.1
13	Chertomlyk GOK	1974	-------	-------	30.0	11.0	30.0	11.0
14	Dneprovsk GOK (Stage 2)	1971	15.0	6.4	-------	-------	15.0	6.4
15	Other	1974	-------	-------	5.0	3.0	5.0	3.0
	C. NORTH-WEST							
16	Kostamuk GOK	1971	10.0	4.0	14.0	6.0	24.0	10.0
	D. URALS							
17	Kachkanar GOK	1971	25.0	4.3	-------	-------	25.0	4.3
18	Kachkanar GOK No. 2	1974	-------	-------	45.0	8.1	45.0	8.1
19	Taratash GOK	1974	-------	-------	15.0	6.2	15.0	6.2
20	Stepnino-Maysk GOK	1974	-------	-------	5.0	2.5	5.0	2.5
21	North-Peschan GOK	1971	8.0	4.0	-------	-------	8.0	4.0
	E. KAZAKHSTAN							
22	Kachar GOK	1972	10.0	4.3	11.0	4.7	21.0	9.0
23	Lisakovsk GOK	1971	24.0	12.2	-------	-------	24.0	12.2
	F. SIBERIA AND FAR EAST							
24	Tagar GOK	1974	-------	-------	20.0	8.5	20.0	8.5
25	Nyuryundin GOK	1974	-------	-------	20.0	8.5	20.0	8.5
26	Garin GOK	1973	5.0	2.5	-------	-------	5.0	2.5
27	Tersin GOK	1974	-------	-------	5.0	3.6	5.0	3.6
	Total	----	233.0	91.5	235.0	88.6	468.0	180.1

Source: Obogashcheniye rud (Ore Concentration). Leningrad, No. 2, 1968, p. 72.

basin with a capacity of 3.5 million tons of ore annually was also completed. The total annual capacity of the pit is to be 13.5 million tons.

The Ingulets GOK, which began operation in 1962, has become one of the largest complexes in the Krivoy Rog. Annual crude ore production, which reached 21 million tons (7.4 million tons of concentrate) in 1967, is to be raised to 30 million tons of crude ore (11.7 million tons of concentrate) in 1975.

New open pits and concentrators at the Southern, Ingulets, and Northern GOK's in Krivoy Rog were under development. Four lines were being installed to produce iron-ore pellets at a new plant of the Central GOK. The Dneprovsk GOK near Kremenchug in Poltava Oblast' with planned annual capacity of 15 million tons of crude ore (6.4 million tons of concentrate) was under construction. Development of the third open pit began at the Novokrivorozhsk GOK in Krivoy Rog basin.

Direct-shipping ore output in the Urals reached about 30 million tons in 1968. In addition, agglomerate output increased from 29 million tons in 1965 to over 30 million tons in 1968. It is planned to start full-scale operation at the Kachkanar GOK in 1970. Kazakhstan, with an output of about 25 million tons of crude ore, ranked third among iron-ore-producing regions, followed by West Siberia, the KMA and the Kola Peninsula.

Iron ore was produced in two regions of Kazakhstan: In Karaganda at the Atasu mine group and in Kustanay at the Sokolovsk-Sarbay GOK.

The Sokolovsk-Sarbay mining and concentrating combine began full-scale operation in 1966. Annual throughput of 26.5 million tons of crude ore ranks it as one of the largest enterprises in the U.S.S.R.

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About 26,000 workers were employed in the combine which produced 14.6 million tons of crude ore in 1968.[11] The 1969 target is 15.4 million tons of crude ore (11.7 million tons of concentrate) and 5.2 million tons of pellets.

The principal ore deposits of the KMA are located in the Belgorod, Kursk-Orel, Staryy Oskol, and Novyy Oskol areas. The largest deposits are the Yakovlevo, Gostishchevo, Lebedinsk, Yuzhno-Lebedinsk, Stoylensk, Mikhaylov, Kurbakin, Pogremets, and Chernyanka.

Three enterprises of the KMA (the Lebedinsk, Mikhaylov and Korobkov) were in operation and produced about 8 million tons of usable ore in 1968, supplying steel works in Lipetsk, Tula, and the Donets basin. The second stage of the Lebedinsk open pit (the Yuzhno-Lebedinsk) with an annual capacity of 2 million tons and the Stoylensk open pit with a capacity of 4 million tons began operations in December 1968. The third stage of the Mirhaylov open pit; and concentrators at Mikhaylov and Lebedinsk were under construction at yearend. The Lebedinsk combine is designed to process 30 million tons of taconite per year and to produce 13 to 14 million tons of concentrate. Construction of the Stoylensk concentrator and the second stage of the Mikhaylov concentrator are slated to begin in 1970 with completion in 1975.

Several iron ore projects were developed in Siberia. New facilities were completed at the Korshunov iron mining and concentrating combine in Irkutsk Oblast', raising capacity to 12 million tons of crude ore and 5.8 million tons of concentrate containing 60 percent iron. The Olenogorsk ore dressing combine in Murmansk Oblast' on the Kola Peninsula employing 3,633 workers produced about 6 million tons of concentrate in 1968.

In 1968 the U.S.S.R. exported 32.2 million tons of usable iron ores, 12 percent more than in 1967. About 70 percent of the total went to East European Communist countries and some 30 percent to the non-Communist nations. Czechoslovakia was the biggest importer of Soviet iron ore followed by Poland and East Germany. Export of iron ore from the U.S.S.R., to Japan will probably double in 1970 compared with the planned level of 1969.

Iron ore exports are slated to rise to 36 million tons in 1970 and estimated levels for 1975 and 1980 are 43 million and 50 million tons respectively.

Iron and Steel.—Pig iron output increased by 4 million tons to a total of 78.8 million tons in 1968. Steel production rose 4.3 million tons to a total of 106.5 million tons. The output of rolled products increased 3.5 million tons to a total of 85.2 million tons, which included 74.0 million tons of finished rolled metal. The industry also produced 11.2 million tons of steel pipe, 5.7 percent more than output in 1967.

The iron and steel industry showed considerable growth quantitatively, but not qualitatively. The plan for production, particularly of rolled products, was not closely geared to market demand because tonnage alone is used in measuring the progress of the industry. Waste metal in the production of rolled products amounts to 22 million tons annually.[12]

The Ukraine, with Krivoy Rog, Zaporozhye, and the Donets basin as the main centers, produced 50 percent of total Soviet pig iron, 41 percent of total ingot steel, and some 53 percent of total rolled products. The second center in rank was the vast area of the Russian Soviet Federative Socialist Republic (R.S.F.S.R.), including the Urals, European Center, and Siberia. Kazakhstan ranked third in ferrous metal production.

In 1968, the Krivoy Rog, Dneprovsk Dzerzhinsk, Zhdanov Il'ich, Zhdanov Azovstal', Yenakiyevo, and Makeyevka Kirov steel plants in the Ukraine operated below their planned capacities. Blast furnaces were idle more than twice as long as the norm provided and rolling mills, converters, furnaces,and sintering equipment were also idle at many steel plants longer than the norm permitted.[13] As of January 1, 1969, 43 blast furnaces, 47 open hearth furnaces, three converts, and 35 rolling mills in the Ukraine operated below planned capacities.

In 1968, plans for the use of oxygen in furnaces were not met because of the lack of oxygen units and the capacities of available oxygen units were used below planned levels. Soviet planned capital investments in new ferrous industry facilities totaled 2

[11] Kazakhstanskaya pravda. Jan. 31, 1969, p. 1.
Moscow, No. 36, September 1968, pp. 26–27.
[12] Ekonomicheskaya gazeta (Economic Gazette). Moscow, No. 36, September 1968, pp. 26–27.
[13] Rabochaya gazeta (Workers Gazette). Feb. 4, 1969, p. 2.

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billion rubles in 1968, a 25-percent increase over the 1967 level. The planned and reported levels of Soviet iron and steel construction in 1968 were as follows:

Item	1968, thousand metric tons		Percent of completion
	Planned	Reported	
Pig iron	3,300	-------	-------
Steel	7,100	1,400	21
Rolled products	2,200	650	30
Coke	3,020	690	23

Source: Koks i khimiya (Coke and Chemistry). Moscow, No. 6, June 1969, p. 4.

The following planned facilities were not completed in 1968: Blast furnaces at the Cherepovetsk and Nizhne-Tagil metallurgical combines, converter furnaces at the Chelyabinsk, Karaganda, Krivorozhsk, and West-Siberian plants, rolling mills at the Novolipetsk, Orsk-Khalilovo, West-Siberian, and Magnitogorsk metallurgical works, coke batteries at the Novolipetsk, Karaganda, and Krivorozhsk plants, four agglomerate lines at the Zhdanov Il'ich plant, and the first stage of a pellet factory at the Kachkanar mining and concentrating combine. Many enterprises of the ferrous industry were using oxygen and natural gas though these were not available in planned quantity for converters, open-hearth furnaces, and blast furnaces, because of insufficient capacity.

It is planned to invest 2,295.8 million rubles in the ferrous industry in 1969. The first stage of the West Siberian steelworks is to be completed in 1970 consisting of two blast furnaces, six converters, three coking batteries, one blooming mill, and other facilities. The 1969 plan envisages increases over 1968 production of 5.8 percent in pig iron, 5.2 percent in steel, 5.9 percent in finished rolled metal, 3 percent in steel pipe; and 7.7 percent in agglomerate and pellets.

According to the plan, six blast furnaces, eight converter furnaces, eight rolling mills, 20 pipe mills, and 11 coke batteries, are to be completed in 1969–70.

During 1969, the Soviet Union plans to bring on stream four blast furnaces with a total annual capacity of 5.6 million tons (Cherepovets, Nizhniy Tagil, Karaganda-Temir-Tau, and Yenakievo); five converters (Karaganda-Temir-Tau, Chelyabinsk, Novokuznetsk, Yenakievo, and Krivoy Rog); four rolling mills (Lipetsk, Novotroitsk, Novokuznetsk, and Magnitogorsk); a pipe mill at the Nikopol' plant; six coke batteries with a total annual capacity of 4.66 million tons (Karaganda-Temir-Tau, Lipetsk, and Krivoy Rog); and new facilities to produce 7.8 million tons of agglomerate and 6.8 million tons of pellets (Kachkanar and Sokolov-Sarbay).

The KMA and the Korshunov and Rudnogor deposits in Eastern Siberia are to be the newest centers of the iron and steel industry. Two steel complexes are scheduled for construction in these areas during 1971–75.

Pig Iron.—Thirty-six enterprises operating 131 blast furnaces produced 78.8 million tons of pig iron in 1968, 5.4 percent more than in 1967. Iron production is slated to rise to 83.4 million tons in 1969, and 88 million in 1970; estimated levels for 1975 and 1980 are 109 million and 130 million, respectively. Average blast furnace capacity was reportedly 1,034 cubic meters.

About half of all blast furnaces were using oxygen for blast enrichment in 1968. About 80 percent of pig iron was produced with the partial use of natural gas.

The largest blast furnace in the U.S.S.R., (2,700 cubic meters), was put into operation in 1967 at the Krivoy Rog metallurgical plant. A second—at the Cherepovets plant—was rescheduled for completion in 1969. Construction of a 3,000-cubic-meter blast furnace was begun at the West Siberian works in 1968 with a planned capacity of about 2 million tons of pig iron annually. It is planned to construct two blast furnaces, with a volume of 3,200 cubic meters each, at the Novolipetsk and the West Siberian metallurgical works. The annual production of each is to exceed 2 million tons of pig iron. The cost of a 2,000-cubic-meter blast furnace ranged from 29.3 to 38.7 million rubles and that of a 2,700-cubic-meter unit cost 41.1 million rubles.

Steel.—Seventy-six metallurgical works produced 106.5 million tons of steel in 1968, 4.2 percent more than in 1967. The 1969 target is 112.6 million tons. It is planned to produce 115 million tons of steel in 1970 and estimated levels for 1975 and 1980 are 140 million and 165 million,

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respectively. Distribution of production by process follows (in percentages):

Process	1965	1967	1968
Oxygen converter	5.0	10.2	11.8
Electric steel	4.9	4.6	4.6
Open hearth	88.0	83.4	81.9
Bessemer	2.1	1.8	1.7
Total	100.0	100.0	100.0

There were about 400 open hearth furnaces in operation in 1968 with an average capacity of 225 tons. Almost half of all open hearth, and about three-fourths of electric furnaces were operated with the addition of oxygen to the blast. Over 50 million tons of steel were produced by oxygen consuming open hearth units and around 60 percent of total national output was produced with the application of natural gas.

Oxygen-converters of 100-ton capacity were in operation at six metallurgical plants in 1968. The existing converters did not reach planned targets and production costs were higher than steel produced in Martin furnaces. Labor productivity was lower than in open hearth shops.

Three 250-ton and two 100-ton converters were under construction in 1968. Production from these converters is planned to start in 1969. The oxygen converter being built at the West Siberian steelworks employed 2,400 construction workers, and that of the Karaganda metallurgical works employed about 5,000 persons.

Electric furnaces of 100-ton capacity were in operation and construction of a 200-ton unit was underway in 1968. About 70 percent of electric steel was produced with the use of oxygen. There were 20 continuous steel casting installations in operation, which produced about 3 million tons in 1968. According to Soviet sources "hundreds of thousands of tons" of steel were melted by the electroslag process in 1968.

Metallurgical enterprises received light unprocessed scrap, which caused difficulties in steel smelting shops. About 50 percent of scrap was prepared manually for remelting and 50 percent of the scrap used was waste from metallurgical production. The share of scrap in the charge of Martin furnaces was 45 percent and that of electric furnaces was 96 percent.

Rolled Products.—Soviet 1968 rolled steel output totaled 85.2 million tons (including finished rolled metal pipes, forged ingots, and rerolling blanks), 4.3 percent more than in 1967. Rolled products output is slated to rise to 89.6 million tons in 1969, and 92 million in 1970; estimated levels for 1975 and 1980 are 116 million and 142 million, respectively. Despite increased total output, the production of some structural shapes remained inadequate. As a result, according to a Soviet source, steel consumption was 20 percent greater than necessary because of the substitution of less efficient but heavier shapes.

Of the total rolled steel produced, over 30 percent came from about 25 rolling mills installed in the 19th century.

At the Novosibirsk iron and steel works an 850-ton rolling mill was completed in July 1968 to produce steel sheet for the automobile and tractor industries. A 250-ton rolling mill was put into operation at the Chelyabinsk metallurgical complex.

Steel Pipe.—In terms of tonnage the Soviet Union was first among world producers of steel pipe. In 1968, a total of 11.2 million tons was manufactured, 5.7 percent more than in 1967. The largest pipe had a diameter of 1,220 millimeters. Fabricating of steel pipe continued to be inadequate to meet internal demand and between 7 and 10 percent of requirements had to be imported in 1968. The Ukraine produced some 4 million tons of pipe and was the main center of pipe manufacturing in 1968. Pipe manufacture is slated to rise to 11.5 million tons in 1969 and 12.5 million tons in 1970; estimated levels for 1975 and 1980 are 16 million and 18.5 million, respectively. In 1975, Soviet output of welded pipe is scheduled to reach about 55 percent of the total.

Soviet iron and steel statistics are shown in table 5.

Lead and Zinc.—The progressive increase in lead-zinc production was due in large part to the appreciable size of easily exploitable reserves, although nearly 90 percent of the production of zinc was from low-grade ores. Reserves of lead were estimated in 1968 at 17 million tons of contained lead and 22 million tons of contained zinc. From 65 to 75 percent of reserves of lead and zinc ores are located in Kazakhstan, chiefly in the Altay region and in the district of Kara-Tau. Large

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Table 5.—U.S.S.R.: Salient iron and steel statistics

(Million metric tons)

Item	Actual				Planned and estimated		
	1955	1960	1965	1968	1970	1975	1980
Iron ore:							
Domestic output	71.9	105.9	153.4	176.6	197.0	242.0	287.0
Imports	-------	(1)	(1)	(1)	(1)	(1)	(1)
Exports	8.8	15.2	24.1	32.2	36.0	43.0	50.0
Apparent consumption	63.1	90.7	129.3	144.4	161.0	199.0	237.0
Pig iron:							
Domestic output	33.3	46.8	66.2	78.8	88.0	109.0	130.0
Imports	.6	.2	.1	.1	.1	.1	.1
Exports	1.1	1.8	3.7	4.5	5.0	6.5	8.0
Apparent consumption	32.8	45.2	62.6	74.4	83.1	102.6	122.1
Steel: Domestic output	45.3	65.3	91.0	106.5	115.0	140.0	165.0
Rolled metal:							
Domestic output	35.3	51.0	70.9	85.2	92.0	116.0	142.0
Imports	.1	.9	.8	1.4	1.4	1.5	1.6
Exports	1.5	2.7	4.5	5.5	6.0	7.3	8.5
Apparent consumption	33.9	49.2	67.2	81.1	87.4	110.2	135.1
Steel pipe:							
Domestic output	3.5	5.8	9.0	11.2	12.5	16.0	18.5
Imports	.1	.6	.8	.8	.8	.9	.9
Exports	.2	.2	.3	.3	.3	.3	.4
Apparent consumption	3.4	6.2	9.5	11.7	13.0	16.6	19.0
Ferroalloys:							
Imports	.005	.015	.006	.009	.009	.010	.011
Exports	.088	.155	.205	.312	.350	.450	.550

[1] Insignificant.

reserves of zinc were also found in the Urals.

In 1968, Kazakhstan accounted for almost half of Soviet zinc production. According to the 1966–70, 5-year plan, production of zinc in this Republic is to be increased 90 percent and that of lead 40 percent. During this period renovation of the Leninogorsk, Zyryanovsk, Achisay and Tekeli combines is to be completed, and the exploitation of new deposits is to be started.

Mercury.—The U.S.S.R. produced about 18 perecnt of the world's mercury and was apparently self-sufficient in mercury in 1968.

A new metallurgical plant at the Nikitov mercury combine in the Ukraine went into operation in December. The complex started to operate two new mercury open pits. The exploitation of these deposits is very economic, with only 2.5 cubic meters of overburden per 1 ton of ore, which is 2.5 times less than in other open pits. The ore was mined from lower levels of the underground mines of the complex and the Novaya mine, which was commissioned in 1967, reached its planned capacity. Construction of the Novozavodsk underground mine began in the vicinity and the mercury output of the complex will increase about 50 percent when it is completed. Elsewhere in the Ukraine, construction began on a mercury mining and metallurgical complex at Vyshkovo in the Transcarpatian Oblast'.

The Plamennyy mercury mine in Chukchi National Okrug in the Soviet Far East did not reach its planned capacity and construction of a metal recovery plant was postponed. Construction began on a mercury mine in Tuva A.S.S.R. The new concentration plant of the Khadarkan complex in Kirgiz S.S.R. began production of mercuric-antimonic fluorine concentrate. A mercury mine and a concentration plant were under development in the Shorbulag region of Azerbaydzhan.

The Vardan mercury deposit in the Southern region of Armenia is considered to be the richest in the republic. An additional four small cinnabar deposits were discovered in the Sevan-Zangezur area. Small deposits of mercury ore were discovered in the Eastern portion of the Pamir Plateau in Tadzhik S.S.R.

Molybdenum.—Output of molybdenum concentrate (metal content) was estimated at 7,000 tons of 10.7 percent of the world total in 1968. About 50 percent of production was based on copper-molybdenum ores from Armenia, Kazakhstan, and

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Sorskoye and others in Siberia; over 30 percent was from molybdenite ore mined in Uzbekistan and at Ulmaltinsk and Chikoysk in Siberia; the remainder came from the tungsten-molybdenum ores of Tyrny-Auz (Kabardin A.S.S.R.) and Dzhida (Buryat A.S.S.R.) and from miscellaneous types.

There are more than 100 known deposits of molybdenum in the U.S.S.R., most of which are too small to be mined economically. Approximately 70 such small deposits are in the Urals, none of which is being worked. Some others, in the eastern parts of the country, are underdeveloped for economic-geographical reasons. Explored reserves of molybdenum in ore (molybdenite, copper-molybdenum, and tungsten-molybdenum ores) in the U.S.S.R. may approach 200,000 tons.

The deposits now in exploitation are in eight geographical groups:

1. Armenia.
2. Eastern Siberia (both east and west at Lake Baykal).
3. North Caucasus (Tyrny-Auz, Kabardin A.S.S.R.).
4. Krasnoyarsk Kray.
5. Uzbekistan (Almalyk District).
6. The Gornyy Altay Range (in the South of Western Siberia).
7. The Bureya River basin and others (Soviet Far East).
8. The Kounrad area (vicinity of Lake Balkhash in Kazakhstan).

Armenia occupied first place in the production of molybdenum concentrate which was shipped out of the Republic for further processing. The Kadzharan copper-molybdenum combine supplied about one-third of Soviet molybdenum in 1968. Open-cast mining and high metal content in the ore have made Kadzharan molybdenum concentrate among the cheapest in the U.S.S.R.

The molybdenum concentrator of the Balkhash metallurgical complex in Kazakhstan and the Dzhidinsk tungsten and molybdenum combine in Buryat A.S.S.R. increased output of molybdenum concentrate in 1968. The Tyrny-Auz tungsten-molybdenum combine in Kabardin A.S.S.R. was being enlarged in 1968. The metal content of the deposit is 0.20 to 0.30 percent molybdenum and 3 times as high in tungsten trioxide, with traces of copper, gold, and silver.

Compared with that in 1967, production of molybdenum concentrate at the Sorsk combine in Krasnoyarsk Kray increased by "several" percent. It is planned to construct a new molybdenum mining and concentration complex in Chita Oblast' by 1976.

Nickel.—The U.S.S.R. retained its position as the world's second largest producer of nickel, with an estimated 100,000 tons of smelter products. All of the known important deposits of nickel ores are situated in the Norilsk in Western Siberia, the Urals, and in the Kola Peninsula. Norilsk was the foremost producer of nickel, the Kola Peninsula second, and the Urals third.

Six smelters were in operation in 1968: Norilsk, Monchegorsk and Pechenga in the Kola Peninsula and Ufaley, Rezh and Khalilovo in the Urals.

Two open pits and one underground mine were in operation at the Norilsk sulfide deposit. The ore averages 0.5 percent nickel, 0.75 percent copper and up to 11 grams per ton of platinum-group metals, mainly palladium and platinum. Ore at the newly discovered Talnakh deposit is averaging about 1.5 percent nickel, about 3 percent copper and up to 11 grams per ton of platinum-group metals. The Mayak underground mine was in operation at the Talnakh deposit. The first shaft of the third underground mine at the Komsomol'sk deposit, Oktyabr', was sunk to a depth of 1,000 meters.

The Pechenga-Monchegorsk area of Kola Peninsula was the nation's second principal nickel producer. The ore at the Monchegorsk deposit is averaging about 0.7 percent nickel, 0.4 percent copper, and some precious metals. According to The International Nickel Company, sulfide ore at Pechenga prior to 1941 graded about 3.8 percent nickel, 1.8 percent copper, and 0.08 percent platinum-group metals. The ores of the Kola Peninsula were mined by both opencast and underground methods. The mining of ore began in 1968 at the Zapadnyy mine of the Zhdanovsk mining and ore dressing combine, which is the largest and most important of the operations at Kola Peninsula.

The No. 3 open pit at the Buranovsk mine of the Kimpersay nickel ore mine administration in Aktubinsk Oblast' in Kazakhstan was put into operation in October 1968.

Tin.—Production of tin, amounting to an estimated 26,000 tons was inadequate to meet internal demand, and about 20

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percent of requirements were imported in 1968. It is planned to increase tin production by 1970 to 1.6 times the 1965 level.

U.S.S.R. tin development was concentrated in the Soviet Far East, Yakutia, Transbaykal, and Kazakhstan. Tin deposits of commercial significance are found in the Maritime Kray, Magadan Oblast', and Khabarovsk Kray. The Maritime Kray produced the greatest amount of tin in the country in 1968. The Khrustal'nyy mining and concentrating combine, which operates lode and placer deposits, was the largest enterprise in the Far Eastern Tin Trust (Dal'olovo) in Maritime Kray.

Three known tin refineries were operating in the Soviet Union in 1968: the Novosibirsk, Ryazan' and the Podol'sk (near Moscow) tin plants. The Novosibirsk central tin smelter's 5-year plan (1966–70) envisages a 54-percent increase in tin output. Concentrates from Siberia and the Soviet Far East were shipped to this plant. It is also planned to increase the output of metal at the Sherlova Gora, Ege-Khaya, Leningrad, Sinancha, and other smelters.

Titanium.—The U.S.S.R. was the world's second largest producer of titanium in 1968 with an output of 11,000 tons. The titanium industry is based mainly on Ukrainian and Siberian ilmenite and rutile, and on titaniferous magnetites and ironstones situated mainly in the Urals, Karelia, and Kola Peninsula. During 1966–70 a 140-percent increase in titanium output is planned.

The most important sources of ilmenite in the Soviet Union are the newly discovered placers in the Ukraine, in the territory along the middle course and basin of the Dnieper River. Kola-Karelia, "one of the world's largest titanium provinces," has "appreciable reserves of titanium ores" in the deposits of Tsagino, Mar'yok, Pyalochnozersk, Sal'nyye Tundry, Pudozhgor, Khanlaut, Venemyak, Koykar, and others.

Other Metals.—The Soviet Union continued to be the world's largest producer of manganese and 1,150,000 tons were exported in 1968. Some 70 percent of total production came from the Nikopol' manganese basin in the Ukraine. The second center of manganese activities was the Chiatura basin in Georgia, and Kazakhstan was third. The output of the Nikopol' basin increased by 1.2 million tons of crude ore in 1968 and that of Chiatura basin by 600,000 tons.

The U.S.S.R. remained the largest world platinum-group metals producer. Production came principally from the Norilsk copper-nickel mines with additional output from the Kola Peninsula combine, and some placer deposits of the Urals. Virtually all platinum and platinum-group metals were produced as byproducts. The U.S.S.R. is steadily expanding its output of platinum-group metals.

As in prior years, bismuth was produced in 1968 as a byproduct of tungsten-molybdenum-bismuth and other complex ores. Cadmium was produced almost entirely from the zinc sulfide mineral, sphalerite.

The U.S.S.R. continued to be one of the world's largest producers and consumers of beryl, beryllium alloys, and metal. The beryllium production schedule was being pushed rapidly. Cobalt was produced at the Norilsk, Severonikel, Pechenganikel, Yuzhuralnikel combines, in the nckel plants of the Urals, and also at some copper plants. The Tuva cobalt combine continued under construction. In February 1968, another unit was put into operation in the electric furnace sector of the cobalt and sulfate plant at the Yuzhuralnikel combine in Orsk.

The second stage of magnesium production started at the Berezniki titanium-magnesium combine and it became the largest producer of magnesium in the country. Selenium and tellurium extraction was centered in 1968 at the Irtysh chemical-metallurgical plant in Kazakhstan and at the Pyshma copper electrolyte plant, respectively.

Production of practically all other metals continued to rise in 1968.

NONMETALS

Asbestos.—In 1968, the U.S.S.R. produced an estimated 800,000 tons of six grades of asbestos. Asbestos production was second only to Canada's, the world's largest producer, and is due for further increases within the next few years. Canadian equipment is being used in large-scale expansion of the industry. Asbestos exports rose from 256,800 tons in 1966 to 285,200 in 1967 and 303,600 tons in 1968.

Over 85 percent of total reserves are situated in the Urals and Kazakhstan, and 14.2 percent in Eastern Siberia. Soviet

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chrysotile asbestos development was centered in the Urals, Kazakhstan, and in the Tuva A.S.S.R. Anthophyllite and other nonchrysotile varieties of asbestos have been mined at the small Sysertsk deposit and other areas.

Treatment plants at the nation's largest deposit in the Bazhenovo (Asbiest) district of the Urals, yielded about 4 percent graded asbestos from ore mined, with the remainder waste. According to the All-Union Building Material Institute, about 50 percent of the waste was used as aggregate, and the rest dumped. Soviet asbestos mines are producing and treating more than 100 million tons of ore and rock yearly, including some 20 million tons of ore.

The Uralasbest combine (Bazhenovo deposit) accounted for about 80 percent of total chrysotile-asbestos output. Explored reserves were reported at 38.7 million tons of asbestos. The deposit's three open pits had a depth of 50 to 125 meters and a total length of 10 kilometers. The No. 6 asbestos plant at this combine, not completed in 1968, was rescheduled to go into operation in June 1969. The plant's crushing and beneficiation facilities will process lean ores with an asbestos content below 3 percent.

The Kustanayasbest combine, exploiting the Dzhetygara deposit in Kazakhstan, accounted for some 17 percent of total chrysotile asbestos output. This deposit contains only medium and lower grades. The first stage of the dressing plant, with a planned capacity of 200,000 tons per year, was commissioned in 1965. The combine employed 6,000 workers and produced some 142,000 tons, or 30,000 tons more than in 1967. The second stage of the combine, with a 400,000-ton planned capacity was under construction and is to be commissioned by 1970.

The third asbestos production center, located in the remote Tuva region adjoining Mongolia, was being expanded. The first stage of the Tuvaasbest combine at Aktovrak, started in 1959 was put into operation in 1966. The second stage was under construction in 1968 and was scheduled to be completed in 1970. The Tuvaasbest combine produced over 4 percent of total Soviet asbestos output. Asbestos from this deposit is of the highest quality and has the greatest fibre length of any known Soviet reserves.

Construction started in 1968 at the Kiembay asbestos deposit in Orenburg Oblast' (Southern Urals). Reportedly, the survey of the Molodezhnoye and Il'chirsk (Buryat A.S.S.R.) chrysotile asbestos deposits have been completed. The known reserves are "large." It is planned to mine these deposits in the future.

According to Soviet sources, a new deposit of chrysotile asbestos was discovered in the Bauntov county of the Buryat A.S.S.R. in 1968.

Fertilizer Materials.—Fertilizer production totaled 10.2 million tons in nutrient content or 43.4 million in bulk fertilizer content[14] in 1968. Of the 43.4 million tons, 20.3 million were nitrogen fertilizer, 10.5 million phosphatic fertilizer, 7.4 million potash fertilizer, and 5.2 million tons were phosphatic flour. Compared with that in 1967, mineral fertilizer output increased over 3.3 million tons, or 8 percent. However, despite the substantial production and large exports, fertilizers were in short supply, and the quality of mineral fertilizers produced did not meet domestic consumer demands.

In 1968, the average percentage of nutrients in Soviet fertilizers just exceeded 27 percent, considerably less than in the United States and Western Europe.

About 3 percent of mineral fertilizers were delivered to firms by automotive transportation directly from supplying plants in 1968. The rest was shipped by railroad. Fertilizers were shipped mostly in bulk causing loading losses, moisture penetration, and difficulties in loading and unloading. Unloading took place at almost 4,000 railroad stations employing manual labor.

New facilities with an annual capacity of 5.1 million tons of mineral fertilizers, or about 80 percent of the planned goal, were commissioned in 1968. New facilities were put into operation at the Uvarovo chemical plant in the Tambov Oblast', the Gomel' superphosphate plant in Belorussia, the Dzhambul double superphosphate

[14] The active ingredients (nitrogen, phosphorus, and potash) are expressed in terms of Soviet standard units which are not the same as used in the United States. Nitrogen is expressed as ammonium sulfate, phosphate is expressed as 18.7 percent P_2O_5, potash is expressed as 41.6 percent K_2O, and ground rock phosphate (phosphatic flour) is expressed as 19 percent P_2O_5.

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Fergana plant and the Chimkent phosphate plant in Kazakhstan, the Tergaka plant in Uzbekistan, the Cherkasy chemical combine in the Ukraine, and the Apatite combine in the Murmansk Oblast'.

Construction of plants and other facilities at the Novgorod chemical complex, the Rovny, Chimkent, Dzhambul and Crimean plants, the Soligorsk, Cherepovets, and Voskresensk combine, and the Karatau combine was much below planned amounts.[15] Shortages of certain machinery, equipment, and materials at construction sites and deficiencies in design resulted in inefficient use of labor and construction delays including the building of the Chimkent[16] and Kuybyshev chemical plants.[17]

Under the original plans for the years 1966–70, 65 million tons of mineral fertilizers were to be produced in 1970, but it does not seem likely that this level will be reached since output in 1968 was 43.4 million tons and that for 1969 is expected to amount to around 47 million tons. Estimated levels for 1970, 1975 and 1980 are 58 million, 100 million, and 145 million tons, respectively.

In the near future, growth rates of phosphate mineral fertilizers output are to be somewhat lower than those for nitrogen and potassium mineral fertilizers.

The Central Committee of the C.P.S.S. and the Council of Ministers of the U.S.S.R. announced May 23, 1968, that the production of mineral fertilizer was to be reorganized and rapidly expanded at considerable expense by 1972. As a result, 95 million tons of fertilizers are to be produced in that year.

The new plans create problems for the mineral industry because the machine building industry does not manufacture some of the most urgently needed equipment in sufficient quantities, or at all.

The Government has set a goal of almost 50 million tons of new fertilizer plants to be commissioned during the 5-year period 1968–72. About 13 million tons of new capacity are to be commissioned in 1969. An additional 35,000 workers were employed on construction sites of the mineral fertilizer industry in 1968; and another 7,000 are to be added in 1969. The amount of 2,373 million rubles is to be allocated for development of the mineral fertilizer industry in 1969, or 37 percent more than was invested in 1968. During 1969 new facilities for the production of complex fertilizers are to be built at the Voskresensk, Novomoskovsk, Nevinnomyssk, and Kuybyshev chemical plants and elsewhere.

Soviet mineral fertilizers statistics are presented in table 6.

Phosphate.—Increased output of phosphate fertilizers in 1968 was attained largely through the commissioning of new capacity rather than greater use of available facilities. Single superphosphate continued to be the basic type of phosphate fertilizer produced.

The Soviet Union possesses two of the world's greatest reserves of phosphate rock: the apatite-nepheline ores in the Kola Peninsula and phosphorites in the Karatau area in Southern Kazakhstan. The apatite concentrate with 39.4 percent P_2O_5 provided about 80 percent of all raw materials for the production of phosphate fertilizers; the remaining 20 percent were produced from phosphorites of the Karatau. Deposits of phosphorites occur also in Upper Kama, Bryansk, the Moscow district, Kingisepp in Leningrad Oblast', and some other regions, but their content of P_2O_5 is rather low. As a rule, they are used to produce phosphorite flour with about 19 percent P_2O_5 content.

In 1968, the U.S.S.R., exported about one-third of its output of phosphate rock and about 53 percent of its apatite concentrate.

Minable reserves of phosphate were estimated in 1968 at 2,700 million tons of phosphate rock (overall average grade, 13.8 percent P_2O_5) including some 250 million tons of proved reserves, and 2,717 million tons of apatite (average grade, 18.5 percent P_2O_5) including around 400 million tons of proved reserves.

Phosphate rock production totaled 40 million tons in 1968, including 24 million tons of apatite ore (17.7 percent P_2O_5) and 16 million tons of sedimentary rock (13 percent P_2O_5).

The apatite-nepheline deposits of the Khibiny in the Kola Peninsula comprised the Soviet's largest single phosphate source. Mined ore, averaging 17 to 18 percent P_2O_5 was concentrated up to 39.4 percent P_2O_5 with 92-percent recovery. The two

[15] Izvestiya. Apr. 17, 1969, p. 3.
[16] Ekonomicheskaya gazeta (Economic Gazette). Moscow, No. 6, February 1969, p. 19.
[17] Stroitel'naya gazeta (Construction Gazette). Moscow, Apr. 18, 1969, p. 1.

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beneficiation plants had a combined capacity of 9.7 million tons of concentrate per year, while four mines (three underground and one open pit) had an annual capacity of 24 million of crude ore in 1968. One produced from open pits was 50 percent of the total. Production of 25 million tons of ore is planned for 1969, to yield 10.5 million tons of concentrate. Estimated output for 1970 is 26 million tons of ore and 10.9 million tons of concentrate; in 1975, 33.5 million tons of ore and 14.3 million tons of concentrate, and in 1980, 47 million tons of ore and 20 million tons of concentrate. Some 50 percent of apatite concentrate will be exported. The production cost for Khibiny apatite was 16.76 rubles per ton of contained P_2O_5 produced; at the Karatau combine it was 35.19 rubles in 1967; it was 37.6 rubles for Kingisepp, 29.0 for Yegor'ev, and 31.8 for Upper Kama phosphorite in 1966.

The Oshurkovo apatite deposit was under exploration in 1968 and it was planned to begin construction of the apatite complex at this deposit in 1971. Annual open pit capacity is to be 12.5 million tons of ore by 1975.

The 40 commercial deposits in the Karatau area of Kazakhstan contain 1,600 million tons of phosphorite. Less than half of the reserves of the basin can be extracted by opencast mining.

Four open pits of the Aksay group of mines and the Molodezhnyy underground mine (Chulaktau deposit) were in operation in 1968. Exploitation of the Kok-Dzhon and Kok-Su open pits (Dzhantas deposit) began in 1968. The total annual capacity of all six open pits was about 4 million tons of crude ore in 1968. The Karatau concentrator reached 35 percent of its planned capacity. The renovation of the recently constructed crushing and grinding mill began in 1968 and the first stage is to be completed in 1969.

Potassium.—Estimated 1968 potash output was 3.15 million tons K_2O equivalent, 9.8 percent over 1967 levels. Soviet potash exports (58 to 62 percent K_2O equivalent) in 1968 amounted to 1.7 million tons compared with 1.4 million tons in 1967.

Under the original 5-year plan (1966–70) for mineral fertilizers, a target of 5.2 million tons K_2O equivalent was projected for 1970. But actual levels of output were considerably below those indicated in the 5-year plan of the fertilizer industry. Estimated levels for 1970, 1975 and 1980 are 4.5 million, 7 million, and 9 million tons, respectively.

Minable reserves of potassium ores were reported in 1967 at 19,600 million tons with 16 to 40 percent K_2O content. Estimated proved reserves are 3,500 million tons. About 70 percent of these reserves are in the upper Kama basin in the North Urals. The reserves are principally carnallite and sylvite with a 13- to 20-percent K_2O equivalent. Recent investigations have disclosed large reserves of sylvinite. The second largest reserve region is Starobinsk in Belorussia which contains sylvinite (16 to 20 percent K_2O). The third important basin L'vov Oblast', is in the Western Ukraine. The most important potash mineral is hartsaltz (16 percent K_2O), with some deposits of carnallite, polyhalite, and langbeinite. Minable reserves of potassium ores in the Turkmen basin were reported in 1967 at 2,306 million tons in categories $A+B+C_1$ and 1,154 million tons in category C_2.

The following six combines were in operation in the U.S.S.R., in 1968: Solikamsk, Berezniki No. 1 (Ural), Soligorsk No. 1 and No. 2 (Belorussia), the first stage of Novo-Stebnikov (L'vov Oblast', Ukraine), and the first stage of Kalush (Ukraine). Berezniki, No. 2 and No. 3, Soligorsk No. 3, and the second stage of Novo-Stebnikov were under construction in 1968. The first stage of Soligorsk No. 3, Berezniki No. 2, and the second stage of Novo-Stebnikov were slated to go into operation in 1969 and the second stage of Soligorsk No. 3, and the second stage of Berezniki No. 3, in 1970. It is planned to construct four combines in 1971–75; namely, Novosolikamsk, Soligorsk No. 4, Berezniki No. 4, and Karlyuk in Turkmenia.

A deposit of potassium salts was discovered near Petrikov, Gomel' Oblast' in Belorussia. According to preliminary Soviet estimates the reserves of this deposit amounted to 850 million tons. A potassium combine is to be built in the future to exploit it.

Nitrogen.—Estimated nitrogen production was 20.3 million tons in 1968. Nitrogen consumption in the U.S.S.R. is mainly in the form of ammonium sulfate and ammonium nitrate fertilizers, although the production of urea and liquid fertilizers has increased during recent years. The

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combined use of coke gas, natural gas, and petroleum byproduct gas continued to increase, while that of coal gas and coke gas showed a further decline. Soviet exports of nitrogenous fertilizers in 1968 amounted to 953,000 tons compared with 825,000 tons in 1967.

Under the 5-year plan for the years 1966–70, 28 million tons of nitrogenous fertilizers were to be produced in 1970, but actual levels of output were below those indicated in the plan. Estimated levels for 1970, 1975, and 1980 were 26 million, 39 million, and 52 million tons, respectively.

Additional facilities put into operation in 1968 included the Fergana (Uzbekistan), Jonava (Lithuania), Rustavi (Georgia), Kokhtla-Yarva (Estonia), and Tolyatty nitrogen fertilizer plants, and the Kirovakan (Caucasus), Salavati (Bashkir A.S.S.R.), and Chirchic (Uzbekistan) chemical combines. New facilities for nitrogen fertilizer production were being built in 37 locations in 1968 and those already operating were being expanded. Among the largest enterprises under construction were The Cherepovets, The Rovny, Grodno, and Fergana nitrogen fertilizer plants and the Novomoskovsk, Nevinnomyssk, and Cherkassy chemical combines.

Other Nonmetals.—The Soviet Union continued to expand diamond mining which was centered in Yakutiya. Construction of the new Aykhal city started in 1968. It is planned to complete construction of concentrating plant No. 11, at the Udachnaya open pit and the second section of concentrator No. 8 at the Aykhal open pit of the Aykhal diamond combine by the end of 1970.

Soviet production of barite, fluorspar, talc, and mica remained inadequate to meet despite large reserves and the development of new mines and beneficiation facilities. High-grade barite, fluorspar, talc, and mica continued to be imported.

The principal producers of sulfur continued to be Rozdol (West Ukraine), Gaurdak, Shorsu, and others (Central Asia), and Alekseyevsk, Vodninsk, and others (Volga region). Some 30 percent of Soviet sulfur was produced as a byproduct or coproduct of pyrite, pyritic concentrates, petroleum refineries, coke ovens, and natural gases. The second stage of the Rozdol combine was under construction and the U.S.S.R.'s largest plant for sulfur production was commissioned at this combine. At the Gaurdak sulfur combine in Turkmenia a new crusher was installed, in-

Table 6.—U.S.S.R.: Salient mineral fertilizers statistics

(Million metric tons)

Item	Actual		Planned and estimated			
	1960	1965	1968	1970	1975	1980
Fertilizer output:						
100 percent nutrient content:						
Nitrogenous	1.0	2.7	4.1	5.3	8.0	10.6
Phosphatic	.9	1.6	2.0	2.6	6.4	10.8
Potassic	1.1	2.4	3.1	4.5	7.0	9.0
Phosphatic flour	.3	.7	1.0	1.2	2.1	3.6
Total	3.3	7.4	10.2	13.6	23.5	34.0
Bulk fertilizer content:						
Nitrogenous	4.9	13.2	20.3	26.0	39.0	52.0
Phosphatic	4.9	8.6	10.5	14.0	30.4	48.6
Potassic	2.6	5.7	7.4	10.7	16.6	21.4
Phosphatic flour	1.5	3.7	5.2	7.3	14.0	23.0
Total	13.9	31.2	43.4	58.0	100.0	145.0
Exports:						
Apatite ore, 17.7 percent P_2O_5	.1	.1	.1	.1	.1	.1
Apatite concentrates 39.4 percent P_2O_5	1.8	3.5	5.1	5.9	7.8	11.5
Superphosphate, not less than 18.7 percent P_2O_5	.2	.2	.4	.5	.8	1.2
Ammonium nitrate	.1	(1)	.2	.2	.4	.7
Ammonium sulfate	.2	.3	.7	1.0	1.5	2.0
Potassium salts, KC, 58 to 62 percent K_2O equivalent	.6	.8	1.7	2.3	3.8	4.3

[1] Insignificant.

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creasing annual output by 50,000 tons. A shop for the recovery of sulfur from waste gases was constructed at the Salavat oil refinery in Bashkir A.S.S.R. New facilities to produce sulfuric acid were put into operation at the Leninogorsk zinc plant, the Ust'-Kamenogorsk lead and zinc combine, the Rubezh chemical combine and elsewhere. A second large native sulfur production facility The Yavorov Chemical-Mining Combine, was under construction in the Ukraine.

Cement output was 87.5 million tons, or 98 percent of planned goals. There were 92 cement plants in operation in 1968, 24 of which did not attain their goals. The plan called for the construction of 3.1 million tons of new capacity in 1968 but only about 2.4 million tons of the total was completed. Growth rates for cement production were lagging behind the growth rates for capital construction. More than 10 million tons of cement, or about 12 percent of the total production, are lost each year in transportation and the production of reinforced concrete.[18] Cement production is slated to rise to 92 million tons in 1969 and to 94.3 million in 1970.

The Zavalov graphite combine in Kirovgrad Oblast', in the Ukraine produced about 2,500 tons of graphite above the 1968 plan. The first plant in the U.S.S.R., for the production of fettled graphite (a raw material for artificial diamonds) was under construction at this combine.

The Baskunchak salt quarry produced over 4.7 million tons of salt in 1968 and over fulfilled the annual plan. A salt concentrating plant was put into operation at the Genichesk salt field in the Ukraine. The Avan salt mine with a capacity of 200,000 tons per year was commissioned in 1968.

Production of practically all other nonmetallic minerals continued to rise in 1968.

MINERAL FUELS

Production of primary energy from mineral fuels, fuelwood, hydroelectric, and nuclear sources rose from 482.8 million tons of standard fuel equivalent in 1955 to 1,076.8 million tons in 1968. The output of oil increased from 101.2 million to 442 million tons of standard fuel equivalent and that of natural gas from 11.4 million to 200 million tons of standard fuel. The share of these two fuels in Soviet primary energy supply rose correspondingly from 23 percent to 59.7 percent during the 1955–68 period. The share of coal (lignite, bituminous, and anthracite) in primary energy supply declined steadily from 63.7 percent in 1955 to 33.1 percent in 1968 and the production of peat and oil shale decreased from 5.0 percent to 2.8 percent. As a result of structural shifts in the fuel balance, the average cost of production of 1 ton of standard fuel declined from 10.27 rubles in 1955 to 6.28 rubles in 1968. In terms of calorific value coal production costs were 10 times higher than natural gas, and 3 to 4 times higher than for petroleum in 1968. While the trend is toward increasing production of crude oil and natural gas, and a decline in the share of coal in total energy output, coal was still the major source of energy consumed in the Soviet Union and will remain so for a number of years.

Almost 30 percent of Soviet capital was invested in the fuel and power industry. Coal and oil represented more than one-third of all freight carried by Soviet railways. But in spite of the expansion of the primary energy industry during recent years, output has not kept up with the demands of the Soviet economy, particularly in the European part of the U.S.S.R., where three-fourths of all power and fuel were consumed in 1968.

Soviet mineral-fuels production is to rise to 1,670 million tons of standard fuel, and total primary energy to over 1,700 million tons by 1980. Compared with 1968 output, gas is to rise by 116 percent, coal by over 12 percent, oil by 75 percent, hydroelectric power by 175 percent, and nuclear power by 250 percent.

In 1980, the share of petroleum and natural gas in total primary energy production will be about 70 percent, and only 23 percent will be in the form of coal.

As shown in table 7, total consumption of all types of primary energy in the U.S.S.R. is to be equivalent to about 1,500 million tons of standard fuel in 1980, about 1.9 times 1968 consumption.

Coal.—In 1968 the U.S.S.R. produced 594 million tons of run-of-mine coal (or an estimated 340 million tons of clean coal) placing it second among world coal producers. The country produced 1.2 million

[18] Ekonomicheskaya gazeta (Economic Gazette). Moscow, No. 36, September 1968, pp. 26–27.

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Table 7.—U.S.S.R.: Total primary energy balance

(Million tons of standard fuel equivalent)[1]

Year	Total primary energy	Coal (lignite, anthracite and bituminous) and coke	Crude oil and petroleum products	Natural and associated gas	Peat	Oil shale	Fuelwood	Hydro-electric power	Nuclear power
1955:									
Production	r 482.8	310.8	101.2	11.4	20.8	3.8	32.4	r 2.9	----------
Imports	16.0	9.3	6.7	----------	----------	----------	----------	----------	----------
Exports	18.9	6.6	12.1	.2	----------	----------	----------	(2)	----------
Apparent consumption	r 479.9	313.5	95.8	11.2	20.8	3.3	32.4	r 2.9	----------
1960:									
Production	r 699.1	373.1	211.4	54.4	20.4	4.8	28.7	r 6.3	----------
Imports	12.3	5.6	6.7	----------	----------	----------	----------	----------	----------
Exports	65.6	16.0	49.3	.3	----------	----------	----------	----------	----------
Apparent consumption	r 645.8	362.7	168.8	54.1	20.4	4.8	28.7	r 6.3	----------
1965:									
Production	r 976.7	r 412.5	r 346.4	r 149.8	17.0	r 7.4	r 33.5	r 10.0	r .1
Imports	10.6	7.6	3.0	----------	----------	----------	----------	----------	----------
Exports	r 128.0	27.7	94.6	.5	----------	----------	----------	r .2	----------
Apparent consumption	r 864.3	r 392.4	r 254.8	r 149.3	17.0	r 7.4	r 33.5	r 9.8	r .1
1968:									
Production	1,076.8	356.0	442.0	200.0	22.7	8.0	33.0	14.7	.4
Imports	9.6	8.2	1.4	----------	----------	----------	----------	----------	----------
Exports	192.9	24.7	165.8	2.0	----------	----------	----------	.4	----------
Apparent consumption	893.5	339.5	277.6	198.0	22.7	8.0	33.0	14.3	.4
1980:									
Production r e	1,718.9	402.0	771.0	432.0	25.0	12.0	35.0	40.5	1.4
Imports	r e 40.7	10.0	r e 14.3	r e 16.4	----------	----------	----------	----------	----------
Exports r e	289.9	28.0	223.0	37.4	----------	----------	----------	1.5	----------
Apparent consumption r e	1,469.7	384.0	562.3	411.0	25.0	12.0	35.0	39.0	1.4

e Estimate. r Revised.

[1] Metric ton of standard fuel equivalent has a calorific value of 7 million kilocalories (7,000 kilocalories per kilogram) or the equivalent of 27,780,000 British thermal units (18,100 Btu per pound).

[2] Negligible.

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tons less of raw coal than in 1967, and 9.6 million below the plan of 603.6 million tons. Production of coal did not meet any of the 1959 to 1968 annual goals and the latter were scrapped when they proved to be unrealistic.

Coal production is slated to rise to 595.3 million tons of raw (341 million tons of clean) coal in 1969. It is estimated that production in 1970 probably will be on the order of 615 million tons of raw coal or 352 million tons of clean coal. Estimated levels for 1975 and 1980 are 640 million raw (366 million clean) and 670 million run-of-mine (383 million clean), coal respectively.

Reserves.—According to Soviet estimates minable coal reserves (bituminous, anthracite, and lignite) in categories A, B, C_1, and C_2 were 523.7 billion tons on January 1, 1968. Of this, 261.4 billion tons were in categories A, B, and C_1 and 262.3 billion tons in category C_2. The estimated proved coal reserves were around 30 billion metric tons. A total of 25 coalfields, eight large coal-bearing areas and more than 650 individual deposits are known. The oldest and largest coal region in the U.S.S.R. is the Donets basin with more than a quarter of the national total. The Kuznetsk coalfield in Siberia with about 20 percent was the second, followed by the Kansk-Achinsk coalfield. Significant coal reserves were located in the Karaganda, Pechora and other coal basins of the U.S.S.R.

Coal reserves by area and by category are shown in table 8.

Table 8.—U.S.S.R.: Minable reserves of coal by area and category

(Billion metric tons)

Area	Minable reserves		
	A,B,C_1	C_2	Total
European U.S.S.R.	59.1	26.1	85.2
Urals	1.8	.2	2.0
Asian U.S.S.R.	200.5	236.0	436.5
Total	261.4	262.3	523.7

Source: Economic Commission for Europe. Coal Committee, VAB/SYMP/COAL/A-10, May, 20 1969, p. 2.

New Capacities.—Ninety coal mines with a total annual capacity of 195 million tons of run-of-mine coal were under construction in 1968, including seven underground mines in the Donets basin with total capacity of 17.5 million tons of raw coal per year and an estimated cost of 632 million rubles.

Of the 19 underground mines and nine open pits planned with a total annual capacity of 19.2 million tons, 17 underground mines and six open pits, with a total capacity of 11.9 million tons of run-of-mine coal (or 61.9 percent), were put into operation in 1968. New preparation facilities (eight plants) to handle 26.2 million tons of run-of-mine coal were planned for 1968, but only 31.4 percent (three plants with a total capacity of 8.4 million tons) of the target was met.

Production Centers.—The 10 major and numerous minor coalfields in the U.S.S.R. produced an estimated 448 million tons of run-of-mine hard coal (bituminous and anthracite) and 146 million tons of lignite in 1968. Production of run-of-mine coal of the major coal basins was as follows: Donets, 210 million tons; Kuznetsk, 104.6 million, Karaganda, 34.2 million, and Pechora, 20.6 million.

The Ukraine, with the Ukranian Donets and L'vov-Volyn coal basins as the main centers, produced 200.5 million tons, including 78.3 million tons of coking coal. However, 9.9 percent of the mines did not fulfill their coal production quotas, 18 percent their labor productivity targets, 21 percent their cost of production goals, and 30 percent of the mines did not attain their planned capacities. The turnover of personnel in the Ukranian coal industry was 25 to 30 percent per year. It is planned to increase coal production in the Republic to 202 million tons of run-of-mine coal in 1969.

The Donets basin (Donbass) continued to be the largest coal producing center and turned out about 52 percent of the country's coking coal. There were about 550 underground mines in operation in 1968. The Donets basin will remain the largest supplier of coal in the U.S.S.R. for a long time to come.

The Kuznetsk basin (Kuzbass) in Siberia, the U.S.S.R.'s second major producer of coal, had 94 underground mines and 14 open pits in operation in 1968. One-quarter of the basin's output was produced from opencast operations.

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Kazakhstan, third in coal output, produced 52.8 million tons of raw coal including the Karaganda basin which produced 34.2 million tons of run-of-mine coal in 1968 from 37 mines. Fourteen of these mines did not attain their planned capacities. In 1970, Kazakhstan is to deliver 64.5 million tons of unwashed coal. The Ekibastuz deposit produced more than 18 million tons from open pits.

According to the Soviet long-range plan, the Karaganda coal basin is to be the main source of supplying of coking coal in the 1970's for the metallurgical industry of the southern Urals, West Siberia, Kazakhstan, and the Central Asian Republics. The plan envisages an annual production of coking coal of approximately 50 million tons by the end of the next 10-year period.

The Pechora coal basin in the Komi A.S.S.R., with a production of 20.6 million tons of raw coal (including 13 million of coking coal) ranked fourth in output in 1968. Some 50,000 tons were mined daily at the 18 underground mines of this basin in 1968. The 1970 production goal was 21.5 million tons, or nearly a 7.5-percent increase over 1968 output.

The Moscow basin which produces around 37 million tons of lignite annually with an ash content of about 45 percent was the fifth major coal producer in the U.S.S.R. in terms of calorific value.

The Donets, Kuznetsk, Karaganda, and Pechora coal basins produced over four-fifths of the total coal output in terms of calorific value and 97 percent of the coking coal in the Soviet Union.

Coal Preparation.—Preparation of coal for the market was normally restricted to coking coals and fuel for export.

During the year, 164 preparation plants employing more than 50,000 workers processed 245.1 million tons of run-of-mine coal or 41.3 percent of the total coal produced. Sixty-three percent of coal beneficiated was washed; about 20 percent was treated by pneumatic methods; and 17 percent was treated by heavy media, flotation, and other methods. From 10 to 15 percent of total coal shipped to consumers in 1968 was reportedly deficient. About 35 percent of the target for the construction of coal preparation plant for 1966–68 was fulfilled. Many new preparation plants were put into operation, some reportedly with imperfections and insufficient equipment. Labor productivity and use of plant capacity were below planned levels and a large number of personnel was occupied in repair and ancilliary operations. The three largest Soviet coal preparation plants—Samsonovsk, Krasnoarmeysk and Yanovsk Ts.O.F.s—reached a little more than 50 percent of their planned capacity in 1968.

The ash content of shipped coals has been rising and increased to 19.6 percent in 1968. According to Soviet calculations, a 0.1-percent increase in the ash content of coal above the established norm, results in an annual loss to the Ministry of the Coal Industry of 16 to 17 million rubles.

Multistage manual preparation on the longwall and hand sorting on conveyers and mine cars was widespread. Some 40,000 men and women were employed in hand sorting rock from coal.

Trade.—Exports of coal and coke from the U.S.S.R. declined to 25.1 million tons from 26 million in 1967. Despite planned reduction in coal output, the policy of increasing exports of coal and coke is to be continued. It is estimated that exports will increase to 26 million tons by 1970, 27 million by 1975, and about 28 million tons by 1980, at a maximum.

As in the past the market for coal from the Soviet Union will be limited mainly to East and West Europe and Japan.

Poland was the major exporter of coal and coke to the U.S.S.R. All of the reported imports of Polish coal and coke are reexports on Soviet account to East Germany and other countries. Imports of coal and coke reached a peak—about 8 million tons—in 1967.

The proportion of imports to total available coal rose from 1.0 percent to 1.35 percent in the 1959–67 period. In 1970, some 8.5 million tons of coal and coke will probably be imported by the Soviet Union and estimated levels for 1975 and 1980 are 9 million and 10 million, respectively. But, all imports of Polish coal and coke will continue to be reexported on Soviet account to other countries.

Soviet foreign trade in coal and coke is shown in table 9.

Natural Gas.—The Soviet Union is among the world's largest producers and consumers of natural gas and a net exporter of this commodity. In 1968, the U.S.S.R. produced 171 billion cubic meters of usable gas, 7 percent more than in 1967, but below the 1968 plan target of 173

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Table 9.—U.S.S.R.: Salient coal and coke statistics

(Million metric tons)

Item	Actual			Planned and estimated			
	1955	1960	1965	1968	1970	1975	1980
Coal:							
Domestic output:							
Run-of-mine coal [1]	391.3	513.2	578	594	615	640	670
Clean coal [2]	247	309.0	331	340	352	366	383
Imports:							
From other Communist countries [3]	8.7	4.7	6.7	7.5	7.8	8.2	9.2
Exports:							
To other Communist countries	2.6	8.2	15.3	12.5	13.5	14.5	15.0
To non-Communist countries	1.7	4.1	7.1	8.8	9.0	9.5	10.0
Total	4.3	12.3	22.4	21.3	22.5	24.0	25.0
Apparent consumption:							
Run-of-mine coal [1]	395.7	505.6	562.3	580.2	600.3	624.2	654.2
Clean coal [2]	251.4	301.4	315.3	326.2	337.3	350.2	367.2
Coke:							
Domestic output	43.6	56.2	67.5	71.5	77.3	88.5	100.0
Imports:							
From other Communist countries [3]	.5	.7	.7	.7	.7	.8	.8
Exports:							
To other Communist countries	1.4	2.2	2.8	2.4	2.4	2.0	2.0
To non-Communist countries	.2	.4	1.0	1.0	1.1	1.0	1.0
Total	1.6	2.6	3.8	3.4	3.5	3.0	3.0
Apparent consumption	42.5	54.3	64.4	68.8	74.5	86.3	97.8

[1] Run-of-mine coal as reported in Soviet sources.
[2] Clean coal; estimated in accordance with Western standards.
[3] None from non-Communist countries.

billion cubic meters. Of this quantity 98.9 percent consisted of natural and associated gas, and 1.1 percent came from the gasification of coal and oil shale. Over three-quarters of the total was produced in the European part of the U.S.S.R., including nearly one-third in the Ukraine. Production of liquefied gas increased by 13.5 percent, reaching 4.1 million tons. The underground storage facilities delivered 2.3 billion cubic meters of gas for consumption, which is almost 1 billion cubic meters more than in 1967. In 1968 gas accounted for 18.8 percent of total U.S.S.R. fuel production.

There were over 330,000 employees in the Soviet gas industry in 1968. During the summer vacation period 10,000 university students worked in the gas industry. In 1969, more than 12,000 students are to be employed in gas industry construction projects.

The gas industry was a source of concern to Soviet planners for its inability to meet any state plan since 1956. Construction of gas industry projects has lagged behind planned goals. Many construction installation organizations did not meet quotas for labor productivity, for reducing production costs, and for fulfilling the profit plans. In many projects, designers were late in providing technical plans. At the gasfields the 1968 plan for completing wells was not met and the gas industry was slow in utilizing capacities of the compressor stations and long-distance gas pipelines.[19]

It is planned to produce 185.8 billion cubic meters of usable gas in 1969. The most rapid rates of growth in 1969 are to be in the gas-producing regions of Komi A.S.S.R. (an increment of about 5 billion cubic meters), the Ukraine (an increment of 2.3 billion), and in the Turkmen S.S.R. (an increment of 3.7 billion). The output of gas is also scheduled to increase in Kazakhstan, in the Dagestan and Chechen-Ingush A.S.S.R., and in Perm and Orenburg Oblast's.

[19] Gazovaya promyshlennost' (Gas Industry). Moscow, No. 5, May 1969, pp. 3–5.

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Liquefied gas output is to rise by 14 percent to 4.75 million tons and further enlargement in the capacity of natural gasoline plants are scheduled for 1969. An increase in the production of liquefied gases at the Minnibayevo, Dolina, Korobki, and Azerbaydzhan gas plants is also projected. New plants having a total capacity of 1.2 billion cubic meters annually are to be completed. The 1969 target for Soviet gas pipeline and spur construction was 6,400 kilometers.

During 1968–70 a total of 37 new gas and gas-condensate fields are to be brought into production, including Vuktyl in the Komi A.S.S.R., Krasnokholmsk in Orenburg Oblast', and Messoyakh in Krasnoyarsk Kray.

Gas output is estimated to rise to 196 billion cubic meters in 1970, 280 billion in 1975, and 370 billion in 1980.

Exploration and Reserves.—Over the 1966–68 years nine large gas and gas-condensate fields were discovered in Tyumen' Oblast': seven gasfields (Urengoy, Zapolyarnyy, Gubkin, Komsomol, Ayvasedorupov, Medvezhye and Nydin) and two oil and gas fields (Novo-Portov and Tazov).

On January 1, 1968, the natural gas reserves of the Soviet Union in categories $A+B+C_1$ were 7,753 billion cubic meters. In addition there were more than 250 promising gas areas ready for exploration, with total reserves in category C_2 of up to 4,000 billion cubic meters. Reportedly, 17 new natural gas and gas-condensate fields with total reserves of 1,669 billion cubic meters in categories $A+B+C_1$ were discovered in 1968. At yearend 1968, natural gas reserves in categories $A+B+C_1$ reached 9,423 billion cubic meters, including an estimated 1,740 billion cubic meters of proved reserves (Soviet category A).

The growth in natural gas reserves for the period 1950–71 is presented in table 10.

Table 10.—U.S.S.R.: Natural gas reserves

(In billion cubic meters as of January 1)

Item	Actual							Planned	
	1950	1955	1960	1965	1966	1967	1968	1969	1971
Categories $A+B+C_1$	NA	NA	2,202	3,220	3,556	4,381	7,753	9,423	11,761
Categories $A+B$	85	389	1,667	2,091	2,021	NA	3,000	3,481	4,443
Category A (proved reserves)[a,b]	43	195	835	1,145	1,010	NA	1,500	1,740	2,220
Ratio of proved reserves to annual output	8	21	19	8	7	NA	9	9	10

NA Not available.
[a] Category "A" is the Soviet equivalent to United States proved reserves.
[b] Estimate.

Sources: 1. Gazovaya promyshlennost' (Gas Industry). Moscow, No. 1, January 1967, pp. 9–16; No. 11, November 1967, pp. 1–7; No. 1, January 1968, pp. 13–18; No. 3, March 1969, pp. 4–6. 2. Mel'nikov, N.V. (ed.). Toplivno-energeticheskiye resursy (Fuels and Energy Resources). Moscow, 1968, pp. 532–534.

Natural gas reserves by region in the U.S.S.R. are given in table 11.

Gasfields.—The Ukraine occupied first place in the production of gas in the U.S.S.R. and produced almost 51 billion cubic meters of gas or nearly one-third of the national total in 1968. Thirty-four gasfields were in operation, including Shebelinka and Efremovka. Shebelinka produced 30.6 billion cubic meters of gas during the year. The Ukraine supplied gas to the Russian union republic, Belorussia, Moldavia, Lithuania, Poland, Czechoslovakia, and Austria. It is planned to put 5 new gasfields into production and to produce 54.4 billion cubic meters of natural gas in the Ukraine in 1969.

Uzbekistan, with an output of 29 billion cubic meters or 17 percent of the total natural output, was the second largest gas producing region. Over 70 percent of the gas was transported to the Urals and to consumers located along the route. There were 231 producing wells in 1968, one-ninth of which were idle. Average cost per well was about 100,000 rubles. The largest gasfield in Uzbekistan—the Gazli—accounted for about 14 percent of total national production.

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Table 11.—U.S.S.R.: Regional natural gas reserves in categories A+B+C_1

(Billion cubic meters)

Republics and Oblast's	Reserves as of 1 January			
	1967	1968	1969	Anticipated 1971
R.S.F.S.R.:				
Komi A.S.S.R.	73.7	136.2	225.7	418.7
Bashkir A.S.S.R.	44.1	46.2	58.6	68.9
Perm Oblast'	34.2	39.2	43.8	60.8
Kuybyshev Oblast'	8.1	8.0	9.2	10.7
Orenburg Oblast'	30.0	29.4	198.9	387.2
Saratov Oblast'	68.1	72.1	78.3	86.1
Volgograd Oblast'	92.7	91.0	94.7	107.9
Astrakhan Oblast'	1.8	1.6	17.9	31.2
Kalmyk A.S.S.R.	15.5	17.1		
Krasnodar Kray	427.6	419.4	392.5	373.0
Stavropol Kray	228.9	222.1	218.9	209.4
Checheno-Ingush A.S.S.R.	8.5	8.5	8.3	8.0
Dagestan A.S.S.R.	53.4	63.1	59.5	85.4
Rostov Oblast'	4.0	4.0	4.0	4.0
Sakhalin Oblast'	57.4	70.1	79.1	102.7
Tyumen Oblast'	895.8	3,850.4	4,882.6	5,871.7
Krasnoyarsk Kray	---	5.0	30.0	126.0
Novosibirsk and Tomsk Oblast's	107.7	182.7	233.3	38.3
Irkutsk Oblast'	20.5	20.5	20.5	30.5
Yakut A.S.S.R.	208.6	238.6	277.7	352.5
Other	---	---	---	345.0
Total	2,380.6	5,525.2	6,933.5	8,718.0
Ukraine	636.5	663.2	693.4	800.0
Azerbaydzhan	46.2	45.2	48.7	56.6
Kazakhstan	131.8	175.8	175.1	261.4
Central Asia:				
Uzbek	663.6	690.1	717.0	769.9
Turkmen	486.5	605.6	803.0	1,069.0
Tadzhik	20.3	32.1	34.8	53.5
Kirgiz	16.0	17.8	17.0	18.2
Total	1,186.4	1,345.6	1,571.8	1,910.6
Georgia	---	---	---	14.0
Grand total	4,381.5	7,753.0	9,422.5	11,760.6

Sources: Gazovaya promyshlennost' (Gas Industry). Moscow, No. 1, January 1968, p. 14; No. 3, March 1969, p. 5.

Krasnodar Kray, with an output of around 17 billion cubic meters, had five major gas-condensate fields in operation in 1968. Stavropol' Kray produced some 16 billion cubic meters of gas during the year. About 100 gas wells were added to the 291 existing wells in this Kray in 1968. Production costs for natural gas in this region were the country's lowest. More than 80 percent of the gas produced in North Caucasus (Krasnodar and Stavropol' krays) was supplied to Moscow, Leningrad, the Donets Basin, Trans-Caucasus, and other economic centers.

Tyumen' Oblast' produced 8 billion cubic meters of usable gas, 3 billion more than in 1967. By 1970 Siberian gas production is to reach 15 to 17 billion cubic meters. Other significant gas producers in 1968 were Volgograd and Saratov Oblast's, Azerbaydzhan, Turkmenistan, Bashkir and Tatar A.S.S.R.s, and Kuybyshev Oblast'.

The Vuktyl gasfield in the Komi A.S.S.R. was brought into production in 1968. Output of gas is scheduled to reach 5 billion cubic meters in 1969 and 8 to 10 billion cubic meters in 1970. Ninety production wells are to be drilled at the Krasnokholmsk gas-condensate field near Orenburg in 1969–70. It is planned to produce some 10 billion cubic meters of gas in Orenburg Oblast' in 1971. In 1969 Turkmenistan is slated to produce 7.3 billion cubic meters of gas, more than double 1968 output: By 1970 Turkmenian gas production is to reach 13.6 billion cubic meters.

Further expansion of the Soviet gas industry is to a great extent dependent upon the creation of the new large gas-producing centers in Western Siberia and Turkmenistan, and the delivery of large volumes of gas to the European part of the U.S.S.R. from these regions.

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There is reason to believe that gas pipeline construction will be inadequate to accommodate the growth originally planned in gas output to 225–240 billion cubic meters by 1970. It is therefore expected that output of gas will reach only 196 billion cubic meters in 1970. Estimated levels for 1975 and 1980 are 280 billion and 370 billion cubic meters, respectively.

Production of natural gas by region in the U.S.S.R. is shown in table 12.

Table 12.—U.S.S.R.: Natural gas production, by region

(Percent)

Republic and economic region	Actual 1965	Planned 1970	Estimated 1975	Estimated 1980
R.S.F.S.R.:				
Northwest	0.5	3.5	3.9	4.0
Povolga	13.9	7.0	7.5	8.0
North Caucasus	33.7	22.1	16.0	11.0
Urals (excluding Tyumen' Oblast')	.1	2.0	4.0	5.0
Siberia (Tyumen' Oblast')	-----	8.0	14.0	20.0
Far East	.3	1.0	1.5	2.0
Total	48.5	43.6	46.9	50.0
Ukraine	34.0	29.0	25.0	20.9
Azerbaydzhan	2.7	3.0	2.5	2.0
Georgia	-----	-----	.1	.1
Kazakhstan	-----	-----	1.5	3.0
Uzbekistan	14.7	17.9	15.0	12.0
Turkmenistan	.1	6.5	9.0	12.0
U.S.S.R. grand total	100.0	100.0	100.0	100.0

Source: Kondrat'ev, V.I. (ed.). Toplivno-energeticheskiye resursy S.S.S.R. (Fuel and Energy Resources of the U.S.S.R.). Moscow, 1968, p. 50.

Transportation.—The great distances of the principal consuming centers from the gasfields have made it inevitable that the bulk of natural gas must be transmitted by large pipelines. Over 80 percent of 1968 natural gas production was carried by trunk pipelines, and 20 percent was consumed at or near the places of production. The total length of gas trunk pipelines was 55,661 kilometers at yearend; 3,361 kilometers of gas trunk pipelines were completed during the year. including the 1,200-millimeter diameter, 700-kilometer Central Asia-Center No. 2, the 752-kilometer Kremencling-Krivoy Rog line, the 220-kilometer Kyzylkum-Krasnovodsk line, and the 150-kilometer Klaypeda-Siauliai line.

Trade.—The Soviet Union continued to export minor quantities of natural gas to Poland by pipeline from the Dashava fields of the Western Ukraine. The 820/720-millimeter, 540-kilometer Friendship gas pipeline from Dashava to Bratislava, Czechoslovakia, completed in 1967, has a planned annual capacity of 4 billion cubic meters. Substantial additional quantities of natural gas will be supplied to Czechoslovakia, Poland, and Austria when the gas pipeline from Kiev to the Western Ukraine, with an annual capacity of up to 10 billion cubic meters, has been laid. Construction is scheduled to start in 1969. The 1,040-kilometer pipeline will have a diameter of 1 meter. More than half of it is to be built in 1969.

A contract, providing for delivery of nearly 30 billion cubic meters of Soviet gas to Austria over the next 23 years was signed in Vienna on June 1, 1968. In accordance with the contract Austria will sell the Soviet Union over 1969–70, 120,000 tons of 1,020-millimeter pipe with a total length of 1,500 kilometers—with the steel to be provided by the Linz-based company, Voest. The pipe will be rolled in West Germany. Under the agreement, the U.S.S.R. supplied Austria 280 million cubic meters of gas in 1968. The quantity will increase to 800 million in 1969 and 1.4 billion cubic meters, annually from 1970 onward. Delivery of the Soviet gas to Austria began September 17 via the Friendship pipeline extended beyond the old Bratislava terminal, in Czechoslovakia, into Austria.

Soviet exports of natural gas to Czechoslovakia increased from 265 million cubic meters in 1967 to 500 million in 1968. In 1969 the U.S.S.R. is to supply Czechoslovakia with about 1 billion cubic meters of gas from fields in the Ukraine and a minimum of 1.3 billion cubic meters per year by 1970. Deliveries of Soviet natural gas to Czechoslovakia will increase substantially, starting in 1971. In return, Czechoslovakia is to supply the U.S.S.R. with large-diameter pipe and turbo compressors for gas pipelines. Soviet gas deliveries to Poland are slated to increase from an estimated 900 million cubic meters in 1968 to 1.5 to 3 billion cubic meters from 1975 through 1980.

According to a 1968 agreement on the supply of natural gas and construction of a natural gas pipeline the Soviet Union is to supply East Germany with natural gas

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from 1972 for an indefinite period. By 1975 the U.S.S.R. will deliver about 3 billion cubic meters of natural gas annually to Bulgaria. For this purpose it is planned to build a 700-kilometer Balkan pipeline connecting Izmail-Varna-Burgas-Plovaliv and Sofia. The first section of the line is scheduled for completion in 1972. Hungary is to be linked with the Friendship gas pipeline running through Czechoslovak territory. The connecting link is to run from Safarikova in Slovakia to the Hungarian border. The Czechoslovakian section will be about 15 kilometers long. Construction is to take place in 1969. Substantially increased deliveries of Soviet gas to Hungary are to begin by 1975.

It is estimated that by 1975 Czechoslovakia might import from the U.S.S.R. about 3 billion cubic meters of natural gas; Poland, over 1.5 billion; East Germany, some 3 billion; Bulgaria, around 2.3 billion; and Hungary, 1.2 billion. Total exports of gas from the U.S.S.R. to East European Communist countries might amount to as much as 16 billion cubic meters in 1980.

The Soviet Union offered natural gas to Japan, Italy, West Germany, and other European countries in exchange for steel pipe and equipment to help in development of the Soviet gas industry. Discussions were carried on with these countries, but no agreements were concluded in 1968.

In December 1968 the U.S.S.R. proposed to Japan the sale of large quantities of natural gas from fields to be developed in Sakhalin and Eastern Siberia for delivery by pipeline or in the form of liquefied natural gas. A Soviet proposal for the delivery of the gas envisaged a three-stage project. In the initial stage a 1,000-kilometer pipeline would be built from Okha to Southern Sakhalin for the supply of 2.5 billion cubic meters of liquefied gas annually to the Japanese port of Hokkaido. These supplies would later be increased to 10 billion cubic meters per year by the construction of pipelines first from Southern Yakutia on the Soviet mainland to Okha and second from Southern Yakutia to Nakhodka where liquid natural gas would be shipped by tanker to Japan.

The Soviets have reportedly offered Italy's State-owned Ente Nationale Idrocarburi (ENI) large quantities of natural gas at prices somewhat lower than those quoted for gas from Libya or Algeria. The gas going to Italy would be transmitted from the Ukraine by pipeline. Should agreement be reached with Italy and Japan it is probable that by 1975 the former will be importing on the order of 5 billion, and the latter about 2.5 billion cubic meters of natural gas per year from the U.S.S.R.

The Soviet-Finnish Commission for Economic Cooperation discussed the building of a gas pipeline to Finland and the participation of Finnish firms in construction projects in the Baltic and the Karelian A.S.S.R.

Should supply arrangements be concluded with West Germany, natural gas would be made available through the extension of the Friendship pipeline from Austria into Bavaria, and the U.S.S.R. could probably begin supplying 500 to 700 million cubic meters in 1970 and some 2.5 billion cubic meters by 1975.

About 1 billion cubic meters of natural gas were imported from Afghanistan in 1968 via the pipeline from Shibarghan to Central Asia. The annual capacity of the pipeline is 4 billion cubic meters. An agreement reached in May 1967 by the Soviet Union and Afghanistan envisaged delivery of 57.7 billion cubic meters of gas to the U.S.S.R. during 1967–85.

The Iran-U.S.S.R. pipeline is scheduled to be completed in 1970 when it is proposed to deliver the first 3 billion cubic meters of gas, rising to 10 billion in 1974–80. Its 1,220-millimeter diameter is the largest in the U.S.S.R.

By 1970, the Soviet Union should be importing from Iran and Afghanistan as much as 5 billion cubic meters. Estimated levels for 1975 and 1980 are 13 billion and 14 billion, respectively.

Soviet natural gas statistics are presented in table 13.

Petroleum.—The U.S.S.R. continued to be the second largest petroleum producing country in the world, surpassed only by the United States. Crude oil output in 1968 increased by 21.3 million tons to a total of 309.4 million tons. An increase of about 19 million tons is expected in 1969. The average annual increase in the past 4 years amounted to 21 million tons. Petroleum production is slated to rise to 350 million tons in 1970, 445 million tons in 1975, and 540 million tons in 1980. Expanded output is to be based largely on the development of the new oilfields in Tyumen Oblast

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Table 13.—U.S.S.R.: Salient natural gas statistics

(Billion cubic meters)

Item	Actual				Planned and estimated			
	1965	1966	1967	1968	1969	1970	1975	1980
Production	129.4	144.7	159.2	171.0	183.0	196.0	280	370
Imports [1]	-----	-----	-----	-----	-----	5.0	13	14
Exports:								
To Communist countries	.4	.8	1.8	1.4	2.0	2.7	11	16
To non-Communist countries	-----	-----	-----	.3	.8	1.4	12	16
Total	.4	.8	1.3	1.7	2.8	4.1	23	32
Apparent consumption	129.0	143.9	157.9	169.3	180.2	196.9	270	352

[1] All from non-Communist countries.

and in Kazakhstan, although these regions will produce less than originally estimated.

The U.S.S.R. has continued to increase its exports of crude oil and petroleum products even though internal consumption has been rising. Exports rose to 73.6 million tons in 1966, to 78.8 million tons in 1967, and to an estimated 86.2 million tons in 1968. Petroleum occupied second place, following machinery and equipment, in total Soviet export trade. Exports of crude oil and petroleum products are expected to rise to 91 million tons in 1969, and 97.5 million tons in 1970; estimated levels for 1975 and 1980 are 129 million and 156 million tons, respectively.

Exploration and Reserves.—To support the planned growth in extraction of crude oil and natural gas the following amounts of exploratory drilling were scheduled: 1968—5,616,000 meters; 1969—6,797,000 meters. By 1970 the annual volume of developmental and exploratory drilling in the U.S.S.R. was estimated to reach 14.8 million meters.

Some 95 percent of the U.S.S.R.'s 1968 exploration target was met, but drilling plans were not fulfilled in several regions including Azerbaydzhan and in some regions of the Volga-Urals area. The average depth of developmental wells was 1,682 meters in 1967 and that of exploratory wells was 2,289 meters. Average depth of wells and drilling costs in 1968 were reported to be about the same as in 1967. The maximum depth of drilling in the U.S.S.R. was 6,806 meters reached on December 25, 1968.

In 1968–70 capital investment in exploratory drilling will amount to an estimated 3.030 billion rubles, including 1,660 billion rubles for oil and 1,370 billion rubles for gas. Assignments from the state budget on the order of 1.310 billion rubles were made for geological prospecting.

According to Soviet sources, 51 crude oil, five gas-oil, 23 gas, and six gas-condensate fields were discovered in the U.S.S.R. in 1968. However, despite the fact that during recent years there have been a number of major discoveries the rates of growth of oil reserves has lagged behind the rate of growth in oil production. Production of crude oil in the U.S.S.R. more than doubled from 147.9 million tons in 1960 to 309.4 million in 1968. According to the Soviet Oil Economy (Neftyanoye khozyaystvo), crude oil reserves in the A and B categories increased by 51 percent over the same period.[20]

During 1961–65 the plan for oil reserves in categories A, B and C_1 was fulfilled by 72 percent, and in 1966 by 82 percent, and for categories A and B corresponding results were 93.5 percent and 86 percent, respectively. In 1968 little increment to reserves was observed in the Kuybyshev and Volgograd Oblast's, in Krasnodar and Stavropol krays, in Azerbaydzhan, Ukraine, Uzbekistan, and in a number of other regions. The current reserves-to-production ratio for the country as a whole has declined by 35 percent, as compared with that in 1955, and by 18 percent as compared with that in 1961.

A particular characteristic of the past 10 years is the significant geographic change in the distribution of oil reserves. Assuming that 95 percent of oil reserves of categories A, B, and C_1 were to be found in the

[20] The Category of "A" reserves is the Soviet equivalent to United States proved reserves.

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European part of the U.S.S.R. as of January 1, 1959, the share of that region in the total had declined to 60.9 percent on January 1, 1968, according to preliminary Soviet data.

Less successful exploratory efforts and the reduction in the amount of reserves added have made it more difficult during the current 5-year plan to support the planned growth of crude oil output in many regions where the producing industry is at a developed stage.

Proved and probable crude oil reserves increased by a total of about 380 million tons in 1968, compared with 360 million tons in 1967. As of January 1, 1969, the reserves of crude oil in the U.S.S.R. are estimated at 28 billion tons, including—proved (Soviet category A), 3.6 billion tons; probable (category B), 5.4 billion; and possible (categories C_1+C_2), 19 billion tons. The probable proved reserves-to-production ratio was 11:1 in 1968. A 30- to 40-percent recovery of crude oil in place was claimed in 1968.

Oilfields and Crude Oil Production.—In 1968, 446 oilfields were in production of which 120 were waterflooded and which provided 70 percent of total national output. Several major fields (for example, certain parts of the Romashkino field, Tuymazy, Shkapovo, Barly, Mukhanovo, Neftyanye Kamni, Malgobek-Voznesensk, Korobki, and others) entered phases of stabilized or declining production. There were about 56,000 wells on January 1, 1968, including around 5,000 inactive wells.

Output of crude oil by principal region for 1968 appears in the following tabulation:

Region	Percent of total
Tatar A.S.S.R.	29.0
Bashkir A.S.S.R.	15.8
Kuybyshev Oblast'	11.1
Azerbaydzhan	7.0
Checheno-Ingush A.S.S.R.	5.2
Perm Oblast'	4.7

About 4 percent of 1968 output was provided by Western Siberia, the Ukraine, and Turkmenia; the share of each of the remaining regions was significantly less.

Despite good progress in developing new oil producing regions, the leading role will still be played by the older developed regions during the next few years. These are the regions of the Volga-Urals, Azerbaydzhan, Checheno-Ingush, and Turkmenia. In the national 5-year plan (1971–75) they will provide around 70 percent of the U.S.S.R.'s output. The oilfields of the Volga-Urals area will continue to lead until the developing oilfields of Siberia, Mangyshlak, and the Ukraine come into their own.

Regional production of crude oil in the U.S.S.R. for 1965, 1970, 1975, and 1980 is given in table 14.

Table 14.—U.S.S.R.: Crude oil production, by region

(Percent)

Republic and economic region	Actual 1965	Planned 1970	Estimated 1975	Estimated 1980
R.S.F.S.R.:				
Northwest	0.9	1.8	1.9	2.1
North Caucasus	8.6	8.7	8.4	8.0
Volga-Urals	71.5	61.1	52.2	40.5
Siberia	.3	7.0	14.0	24.8
Far East	1.0	1.1	1.1	1.1
Total	82.3	79.7	77.6	76.5
Ukraine	3.1	4.8	4.6	5.0
Belorussia and Baltic	-------	1.0	1.7	2.8
Trans Caucasas (Azerbaydzhan and Georgia)	8.9	6.5	5.5	4.8
Kazakhstan	.8	3.8	5.6	6.7
Central Asia	4.9	4.7	5.0	5.2
U.S.S.R. grand total	100.0	100.0	100.0	100.0

Source: Kondrat' ev, V.I. Toplivno-energeticheskiye resursy S.S.S.R. (Fuel and Energy Resources of the U.S.S.R.). Moscow, 1968 pp. 47–48.

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Offshore Production.—Several offshore fields have been developed in the Caspian Sea off Azerbaydzhan. The "Neftyanye Kamni" ("Oil Stones") field is 20 to 25 kilometers from the coast and was the biggest in Azerbaydzhan. In 1968, 12.5 million tons, or 59.2 percent of Azerbaydzhan's total output, was obtained from offshore fields. Although the cost of developing offshore fields was considerably higher than for onshore fields, the production cost of the crude oil was 30 to 35 percent below that of onshore fields because the average yield from offshore wells exceeded yields from onshore wells by 2.5 to 3 times. Drilling platforms were installed at water depths of 10 to 22 meters and construction of platforms for wells at depths of 25 meters began in the northeast region of Neftyanye Kamni.

In 1967, the floating platform "Apsheron" began drilling its first deep (1,800 meters) well near Savenko Bank and by December 8, 1968, completed drilling its 14th oil well. Water depth in this region of the Caspian Sea reaches 13 to 14 meters. The "Apsheron" is generally used for Caspian Survey work, but it drilled two development wells 0.5 kilometer from shore in the Bukhta Il'icha area. A larger platform of the same type, called "Azerbaydzhan" was under construction in 1968. A floating rig, the "Khazar," built in the Netherlands to Soviet specifications, was put into operation in 1968. It is capable of drilling in the Caspian Sea where water depth is not more than 60 meters. The equipment was built for drilling to a depth of 6,000 to 7,000 meters. The "Khazar" completed drilling its first oil well on November 5 in the region of Glinyanyy Island, to a planned depth of 1,994 meters, and began drilling the second well near Neftyanye Kamni. In this area the water depth reaches 43 meters and the thickness of silt, 10 meters.

An experiment is to be conducted in the Caspian Sea, where a 1,000-meter well is to be drilled in 200 meters of water. A special ship-mounted rig and other equipment are to be built in France.

Preparation for construction of two bases for offshore drilling near Zhdanov Bank at Chelekan and plans for the construction of Turkmenia's first 25-kilometer underwater oil pipeline were nearing completion at yearend. The 1970 target is 3 million tons of crude oil from 146 wells.

According to Minister V. Shashin, offshore oilfields may be developed in the future on the Black, Azov, and some of the northern seas.

Refining.—In 1968 annual primary oil refining capacity was increased 6.6 percent over that in 1967. Nearly 80 refineries were in operation with a total estimated capacity of 266 million tons. The 1969 plan envisages an increase of 5.9 percent over 1968 crude oil refining capacity.

In 1968, additional primary refining capacity was commissioned at the Ryazan' Omsk, Angarsk, and other oil refineries. New facilities for crude oil refining were under construction at Polotsk, Perm, and Komsomol'sk. Construction of the Mozyr oil refinery began in Belorussia. Plans were completed for remodeling and expansion of the Angarsk and Krasnovodsk oil refineries. It is planned to construct new refineries at Jurbarkas in Lithuania, at Chardzhou, in Turkmenistan, and on the Mangyshlak Peninsula in Kazakhstan.

In 1968, new installations of secondary refining facilities were under construction at Angarsk, Omsk, Volgograd, Ryazan' Yaroslavl', Ufa, Saratov, and the Western Ukraine. New facilities for catalytic cracking were commissioned at the Angarsk, Batumi, Yaroslavl', Krasnovodsk, Syzran', and Perm oil refineries.

The State Standard (GOST 9965–62), established in 1962, for crude delivered to refineries from producing fields required a salt content of not more than 40 milligrams per liter, water—not more than 0.1 percent, and sediments—not more than 0.005 percent. As of January 1968 Soviet oilfields had about 20 percent of the facilities required to meet these standards. In 1968 the content of water in crude oil delivered to refineries ranged from 0.5 to 2 percent and the content of chloride salts was 1,000 to 3,500 milligrams per liter. Refinery consumption and losses during the year were 13.4 percent of throughput.

Losses of light hydrocarbons in storage and during the movement of crude from the well to the refinery averaged 2.5 percent of production. Expenditures for labor and material in the repair of refinery equipment and apparatus increased to an average of 1.2 million rubles per million tons of refined crude per year, and the consumption of steel per million rubles of

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repair work rose from 400 to 600 tons during the year.[21]

No new refineries were constructed from 1962 through 1967, though the demand for oil products increased considerably. For several years oil refineries at Krasnoyarsk and Pavlodar have been included in long-term plans, but neither of these important projects had been started up to 1968.

There was some renovation of old, inefficient refining units, but most of the obsolescent plants were kept onstream because of the critical need for processing capacity.

Operations at some oil refineries were handicapped by shortages of railway tank cars for the movement of oil products and some units had to be temporarily shut down causing mazut to be "mixed-in" with light oil products.

During the 1966–70 period the Soviet Union plans to invest over 6.5 billion rubles in construction in the refining and petrochemical industries. This is twice as much as was invested in the 1961–65 period, but the capacity of secondary processing facilities, as anticipated for 1970, will be inadequate.

An agreement was signed in Moscow December 26 with the French firms GEXA and TECHNIP for the construction of a hydro cracking unit with a capacity of 1 million tons of crude per year. The value of the contract is $20 million. The unit will be installed at the Novoufimsk oil refinery in the Bashkir A.S.S.R. The contract follows two others GEXA has made with the Soviets. The three contracts together amount to about $50 million.

Transportation.—About two-thirds of the total tonnage of crude oil and refinery products moved in the U.S.S.R. in 1968 was shipped by rail. The mileage of trunk pipelines increased in 1968 by 1,014 kilometers and totaled about 30,000 kilometers, including some 25,000 kilometers of crude oil lines and over 5,000 kilometers of product lines. Some 70 percent of total pipeline capacity was utilized in 1968. It is planned to complete 1,900 kilometers of crude and product pipelines in 1969.

In 1968 the following crude oil pipelines were completed: Almet'evsk-Gor'kiy No. 3 (600 kilometers); Perm'-Osa (108 kilometers); Zapadnyy Surgut-Ust'-Balyk (32 kilometers); Buguruslan-Krotovka; and Ozek-Groznyy. More than 160 filling stations and 800,000 cubic meters of storage were built during the year. Construction continued on the following trunk crude oil pipelines: Malgobek-Tikhoretsk (484 kilometers); Yaroslavl'-Kirishi, Okha-on-Sakhalin-Komsomol'sk-on-Amur No. 2 (620 kilometers); Mangyshlak (Uzen)-Gurev-Kuybyshev (1,506 kilometers); Aleksandrovsk-Anzhero-Sudzhcnsk-Krasnoyarsk (1,300 kilometers); and Nizhnevartovsk-Ust'-Balyk (252 kilometers).

A pipeline to carry gasoline from Groznyy to Rostov, a distance of 600 kilometers, is planned. Economic studies regarding the projected 6,500-kilometer crude oil pipeline from Ust'-Balyk in Western Siberia to the Soviet Far East have been completed. Construction is to begin in 1971 and is to be completed in 3 years.

The Friendship pipeline with a total length of 4,648 kilometers crosses five countries. The longest section of the pipeline lies within the Soviet Union, stretching from Almet'evsk in Tatar A.S.S.R. to the Czechoslovakian border, a distance of 3,004 kilometers. Second in terms of length is the portion within Czechoslovakia with a length of 831 kilometers. The length of the Polish sector is 656 kilometers and the Hungarian —130 kilometers. In East Germany the pipeline extends to Schwedt, a distance of 27 kilometers from the Polish border. Since the coming into operation of the pipeline in 1962 until September 1, 1968, 77.5 million tons of crude oil have been delivered via the pipeline to CEMA members. Cumulative deliveries of Soviet oil to Czechoslovakia via the Friendship pipeline to September 1 totaled 32.8 million tons. The pipeline has delivered a total of 12.2 million tons to Poland, 21.1 million tons to East Germany, and 11.0 million tons to Hungary. The supply of oil to these four countries increased by about 25 percent in 1968. The ninth and final oil pumping station of the Friendship line was put into operation in September 1968. In the near future the capacity of the pipeline is to be increased by about 25 percent. A new section of the Friendship line, more than 500 kilometers long linking Polotsk with the Baltic port of Ventspils, was brought into operation March 12, 1968. Latvia operated 35 oceangoing tankers based on Ventspils.

[21] Ekonomicheskaya gazeta (Economic Gazette). Moscow, June 1968, No. 26, pp. 14–15.
Khimiya i tekhnologiya topliv i masel (Chemistry and Technology of Fuels and Oils). No. 8, March 1968, pp. 1–7.

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Construction of Friendship crude oil pipeline No. 2 continued and a 194-kilometer stretch of the 320-kilometer section between Brody and the Soviet-Czechoslovak border was completed in 1968. It was planned to complete several pumping stations and to lay an additional 450 kilometers of pipeline by the end of 1969, including the Kuybyshev-Unecha and Mozyr-Adamova/Zastava sections. The No. 2 pipeline, which parallels the original Friendship line, is to be 3,200 kilometers long, and 1,200 millimeters in diameter.

The average length of haul of petroleum products increased in 1967 to 1,267 kilometers compared with 1,144 kilometers in 1965. Much of the ultralong movements reflected the hauling of large amounts of light products from the Volga-Urals and Caucasus to Kazakhstan, Eastern Siberia, and the Soviet Far East, and also reflected the movement of furnace mazut in a reverse direction.

Lags in pipeline development have hampered oilfield operations in Kazakhstan, Turkmenia, Siberia, and elswhere.

Consumption of Petroleum Products.—The actual and estimated consumption of petroleum products in the Soviet Union was as follows, in million metric tons:

Consumer	1959 actual	Estimated		
		1965	1968	1970
Industry	43.7	72.1	86.7	101.5
Agriculture	19.4	29.8	33.0	36.0
Transport	15.5	28.2	36.0	42.0
Domestic	2.5	3.9	4.4	5.0
Military and others	16.0	22.7	30.0	33.0
Total	97.1	156.7	190.1	216.5

Transportations share of total petroleum consumption is expected to grow from 16 percent in 1959 to 23 percent in 1980, with road and air transport the most significant consumers.

As of January 1, 1967, there were 1,764 filling stations and 660 tank trucks in operation in the R.S.F.S.R. Soviet calculations indicate that for normal servicing of automotive transport in the R.S.F.S.R. not less than 5,000 to 6,000 stations were needed in 1967. The development of automotive transport in the current 5-year plan in connection with the construction of the automobile plant at Tolyatti, which is to produce up to 600,000 cars annually and the reconstruction of a number of existing auto factories to step up their output, will create a demand for not less than 10,000 filling stations by 1970. However, Glavneftesbyt R.S.F.S.R. plans from 1967 through 1970 to build only 800 filling stations and 900 tank trucks, including 70 filling stations in Moscow.

In 1967, there were 100 filling stations in Moscow, 47 in Leningrad, 12 in Novosibirsk, and nine in Rostov/Don. In 1965 the sale of petroleum products through one filling station at the R.S.F.S.R. averaged 3,800 tons per year.

It is planned to build about 8 million cubic meters of storage capacity, 1,000 filling stations, and 150 new oil terminals in the Soviet Union in 1966–70. Capital investments for this purpose are to be in excess of 450 million rubles.

The consumption of petroleum products in Moscow was 3.6 million tons or 10,000 tons per day in 1967.

Trade.—The U.S.S.R. has not yet released official data on Soviet exports and imports of crude oil and petroleum products in 1968. Estimated exports of oil totaled 86.2 million tons in 1968, a 9-percent increase over those in 1967. Of the 1968 total, 69 percent was crude oil and 31 percent was products. Forty-seven percent of crude oil exports and 65 percent of product shipments were exported to non-Communist countries and the rest went to other Communist countries.

In 1968, Soviet crude was pumped to Czechoslovakia, East Germany, Poland, and Hungary through the Friendship pipeline. Deliveries to other countries were by tanker and by rail.

The 1970 export picture is reasonably clear. According to signed trade agreements between the U.S.S.R. and other countries, petroleum exports from the U.S.S.R. will probably increase from 86.2 million tons in 1968 to 97.5 million tons in 1970.

Based on the latest Soviet forecasts, oil exports from the U.S.S.R. will show further significant growth by 1980, perhaps attaining 120 million tons of crude oil and 36 million tons of products per year. In 1980 the Soviet Union will probably be importing some 10 million tons of crude from non-Communist countries (Iraq, Algeria, and other developing countries).

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Crude oil and product exports from the U.S.S.R. to non-Communist countries probably will rise from an estimated 44.7 million tons in 1968 to 64 million tons in 1980.

The East European countries are becoming more self-sufficient in refining capacity. Plans have been announced to increase 1968 refinery capacity in these countries. Eventually Soviet oil exports to these countries will be mostly crude oil.

Although Soviet oil exports are increasing, the country's share of the international oil trade during 1969–80 is expected to remain constant at 4 to 5 percent.

The Soviets expressed readiness to supply an annual average of 10 to 15 million tons of petroleum to Japan over 20 years on the condition that Japan furnish the necessary pipe and related facilities to the U.S.S.R. A definite target date (1971–74) was set for building the 6,500-kilometer trans-Siberian pipeline to carry crude oil exports for Japan. A Baltic line to the Latvian port of Ventspils was completed in 1968. This and other sections of the Friendship pipeline will supply oil to Western Europe in addition to the oil shipped from the Black Sea ports.

Actual and estimated exports of crude oil and products from the U.S.S.R. are presented in table 15.

Nuclear Energy.—The total installed capacity of all Soviet atomic powerplants was 565,000 kilowatts, or about 0.4 percent of the capacity of all electric powerplants in the country on January 1, 1969.

The first Soviet atomic powerplant, the Obninsk, with a capacity of 5,000 kilowatts was put into operation in 1954. The initial section of the Beloyarsk Kurchatov plant near Sverdlovsk in the Urals, with a capacity of 100,000 kilowatts and using a single-cycle boiling water reactor, was activated in April 1964 and the second section with a capacity of 140,000 to 200,000 kilowatts with a double-cycle boiling water reactor was started in December 1967. The Novo-Voronezh having a design capacity of 210,000 kilowatts began producing electric power in October 1964 and a 50,000-kilowatt atomic plant was activated in the town of Melekess in the Ul'yanovsk Oblast' in November 1965. All the existing Soviet atomic powerplants were using uranium-235 for fuel.

Facilities were under construction in 1968 as follows: A second unit with a capacity of 365,000 kilowatts at the Novo-Voronezh plant; the first section of the Bilibino plant on the Chukotka Peninsula in the Soviet Far East with a capacity of 12,000 kilowatts; the first dual-purpose nuclear power plant using a sodium-cooled fast reactor with desalination capability in

Table 15.—U.S.S.R.: Salient petroleum statistics

(Million metric tons)

Item	Actual			Planned and estimated				
	1965	1966	1967	1968	1969	1970	1975	1980
Crude oil:								
Domestic output	242.9	265.1	288.1	309.4	328.0	350	445	540
Imports	-----	-----	(1)	-----	-----	-----	5	10
Exports:								
To Communist countries	22.4	25.5	27.2	32.0	35.0	40	62	80
To non-Communist countries	21.0	24.8	26.9	27.2	28.0	29	35	40
Total	43.4	50.3	54.1	59.2	63.0	69	97	120
Crude product conversion:								
Crude oil to refineries	199.5	214.8	234.0	250.2	265.0	281	353	430
Refinery capacity	225.0	238.0	252.0	266.0	280.0	295	370	450
Refined oil:								
Output from crude	173.0	185.0	199.0	212.0	225.0	239	300	366
Natural gas liquids	2.8	3.0	3.7	4.1	4.7	5	8	12
Imports	1.9	1.7	1.4	1.0	1.0	1	(1)	(1)
Exports:								
To Communist countries	6.5	6.7	8.0	9.5	10	10	11	12
To non-Communist countries	14.5	16.6	16.7	17.5	18.0	18.5	21	24
Total	21.0	23.3	24.7	27.0	28.0	28.5	32	36
Apparent consumption	156.7	166.4	179.4	190.1	202.7	216.5	276	342

[1] Insignificant.

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Shevchenko, Kazakhstan, on the Caspian Sea with a design capacity of 150,000 kilowatts and 120,000 cubic meters per day of fresh water; and the Kola plant in the Murmansk Oblast' with a design capacity for the first section of 200,000 kilowatts.

An experimental fast neutrons reactor with an installed capacity of 60,000 kilowatts was put into operation in Melekess in December 1968. A miniature atomic powerplant, designed especially for the Soviet Far East, was developed in the Physical Energy Institute at Obninsk near Moscow. The reactors are designed for a turbine output of 1,500 kilowatts.

The Novo-Voronezh plant generated over 4 billion kilowatt-hours in the period 1964–68. Reportedly, generating costs were 20 percent higher than those of coal-fired thermal powerplants. The Beloyarsk atomic plant generated 2.5 billion kilowatt-hours in 5 years.

The U.S.S.R. will probably increase the production of nuclear power from an estimated 3 billion kilowatt-hours in 1968 to 3.5 billion in 1970, 6 billion in 1975, and 11 billion by 1980. Nuclear power output is to represent about 0.6 percent of national power production and about 0.1 percent of total Soviet primary energy output by 1980.

Soviet atomic generating capacity is slated to rise to 1,092 megawatts in 1970; estimated levels for 1975 and 1980 are 2,188 and 3,272 megawatts respectively. Soviet atomic energy statistics are presented in the following tabulation in megawatts.

Nuclear plant and unit	Actual, Jan.1, 1969	Planned and estimated at December 31		
		1970	1975	1980
Obninsk	5	-----	-----	-----
Beloyarsk No. 1	100	-----	-----	-----
Beloyarsk No. 2	200	-----	-----	-----
Beloyarsk No. 3	-----	-----	200	-----
Beloyarsk No. 4	-----	-----	-----	200
Novo-Voronezh No. 1	210	-----	-----	-----
Novo-Voronezh No. 2	-----	365	-----	-----
Novo-Voronezh No. 3	-----	-----	440	-----
Novo-Voronezh No. 4	-----	-----	-----	440
Melekess	50	-----	-----	-----
Shevchenko	-----	150	-----	-----
Bilibino No. 1	-----	12	-----	-----
Bilibino No. 2	-----	-----	12	-----
Bilibino No. 3	-----	-----	24	-----
Bilibino No. 4	-----	-----	-----	24
Kola Peninsula No. 1	-----	-----	200	-----
Kola Peninsula No. 2	-----	-----	-----	200
Armenia No. 1	-----	-----	220	-----
Armenia No. 2	-----	-----	-----	220
New capacity	565	527	1,096	1,084
Total capacity	565	1,092	2,188	3,272

An atomic powerplant with a capacity of 70,000 kilowatts was completed in East Germany in May 1966 with Soviet assistance. The first atomic powerplant in Czechoslovakia, with a capacity of 150,000 kilowatts was under construction in 1968; it is anticipated that it will go into operation at the end of 1970. According to a November 1966 agreement between the U.S.S.R. and Czechoslovakia a second plant, with a capacity of 300,000 kilowatts, is to be constructed in Czechoslovakia in the future. Atomic powerplants are also to be built with Soviet assistance in Bulgaria and Hungary. In Hungary plans call for the first unit of an atomic plant to be built on the shores of the Danube, near Paks village, by 1975. A Bulgarian plant is to be built on the lower reaches of the Danube, near Kozlodu village.

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The Mineral Industry of the United Arab Republic

By Henry E. Stipp [1]

Mineral industry developments in 1968 were centered chiefly in the petroleum sector which registered a significant increase in production and exploration activity. The El Morgan field in the Gulf of Suez continued to expand output and together with the field at El Alamein, which began production in August, provided sufficient crude petroleum for United Arab Republic (U.A.R.) requirements and also some for export. New discoveries of crude oil were made at Umm Barka, about 90 miles from the Libya border and also at a site 10 miles south of the El Morgan field. Wildcat wells were being drilled 60 and 140 miles west of Cairo in the Western Desert of the U.A.R. Egyptian General Petroleum Co., with the help of U.S.S.R. technicians, were preparing for operations in the Siwa Oasis area southwest of the Qattâra Depression. The third natural gas well was successfully completed in the Nile Delta area. In other sectors of the mineral industry, expansion of iron and steel facilities was planned and phosphate rock output was being increased both for domestic consumption and export. The use of fertilizer materials in the U.A.R. has been expanding rapidly as a result of government efforts to increase agricultural production. Despite the rise in output of a number of mineral commodities, significant decreases occurred in the production of several key minerals.

Data for evaluating the role of the mineral industry in the total economy of the U.A.R. in 1968 were not available. However, in 1967 mineral and metal production was valued at $312 million [2] compared with $313 million in 1966. The value of 1967 mineral output represented about 6 percent of the nation's 1966 (latest year available) gross national product estimated at $5,075 million. The value of crude mineral commodity production in 1968 was probably somewhat larger than that of 1967, due chiefly to the expansion of the petroleum sector.

A project to survey the mineral potential of the Aswan region was scheduled to begin in 1969. The cost of the program, estimated at about $3.7 million, was being shared by the U.A.R. Government and the United Nations.

PRODUCTION

A substantial increase occurred in the output of crude petroleum in 1968 despite the loss to Israel of the Sinai oilfields. These fields contributed more than half of U.A.R. prewar (June 1967) crude production. Output of petroleum refinery products declined, owing to destruction of refinery facilities at Suez by Israeli artillery which occurred in the latter half of 1967. Phosphate rock production increased sharply as a result of several government projects designed to raise output and quality of concentrate at deposits which are being depleted of high-grade ore. Although figures for cement manufacture were not available for 1968, production probably decreased slightly from that of 1967, as a result of completion of

[1] Physical scientist, Division of International Activities.

[2] Where necessary, values have been converted from Egyptian pounds (£E) to U.S. dollars at the rate of £E1=US$2.30.

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Table 1.—United Arab Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum, metal, semimanufactures	3,831	5,155	6,220	6,539	NA
Copper, metal, semimanufactures and unwrought	8,019	7,057	6,941	5,441	NA
Iron and steel:					
Iron ore and concentrate....thousand tons	447	507	440	423	447
Pig iron....do	192	190	215	NA	NA
Steel ingots and castings....do	176	179	195	• 200	NA
Semimanufactures....do	375	340	r 384	430	NA
Lead and zinc, mine output, gross weight	--------	--------	r 55	1,143	1,329
Manganese, ore and concentrate, gross weight thousand tons	328	182	186	75	4
Titanium:					
Ilmenite concentrate, gross weight	21	--------	r 551	1,062	NA
Rutile concentrate, gross weight	--------	--------	34	6	NA
Zirconium, concentrate, gross weight	41	--------	389	50	NA
NONMETALS					
Asbestos	1,578	2,926	1,866	1,937	• 2,500
Barite	4,551	15,353	6,799	1,282	373
Cement, hydraulic....thousand tons	2,521	2,422	r 2,637	r 2,754	NA
Clays:					
Fire clay....do	[1] 436	[1] 447	495	568	NA
Kaolin (including china clay)	62,796	47,775	49,987	32,120	31,272
Refractory	[2] 39,989	[2] 72,915	[2] 63,604	NA	77,790
Diatomite	--------	--------	--------	--------	1,221
Feldspar, crude	4,728	• 4,000	3,499	NA	1,718
Fertilizer materials:					
Crude (natural):					
Nitrates	4,652	4,218	NA	NA	NA
Phosphate rock....thousand tons	613	594	661	683	1,441
Manufactured:					
Nitrogenous, gross weight....do	783	714	750	618	NA
Phosphatic, including Thomas slag thousand tons	244	287	308	347	NA
Gypsum and anhydrite, crude....do	337	229	459	545	406
Mica and vermiculite	416	580	NA	NA	NA
Pigments, natural mineral, iron oxide	325	370	1,080	345	385
Pumice [e] [3]	12,700	13,700	--------	4,200	4,717
Salt, marine....thousand tons	675	494	627	584	622
Sodium, caustic soda	16,298	18,861	19,310	18,944	NA
Stone, sand and gravel, n.e.s.: Dimension stone:					
Basalt....thousand cubic meters	411	r 253	380	333	336
Dolomite....thousand tons	30	36	25	NA	78
Granite....thousand cubic meters	241	313	24	12	27
Limestone and other calcareous....do	2,692	3,051	3,376	3,218	4,000
Sand and gravel (including glass sand)....do	3,584	3,839	3,412	2,833	1,298
Sandstone....do	157	221	--------	55	67
Sulfur, elemental, byproduct (recovered)	2,466	3,851	11,674	8,981	3,200
Talc, soapstone, steatite and pyrophyllite	16,821	39,628	29,638	NA	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal....thousand tons	--------	67	60	NA	--------
Coke:					
Oven and beehive....do	• 35	257	274	• 275	NA
Low temperature and gashouse [e]....do	35	40	50	NA	NA
Gas:					
Manufactured, all types....do	46	43	49	35	NA
Natural, liquefied (LPG) thousand 42-gallon barrels	602	696	850	708	496
Petroleum:					
Crude oil....do	43,915	45,556	44,070	39,547	• 52,338
Refinery products:					
Gasoline and naphthas....do	6,435	7,302	r 7,215	6,258	6,520
Kerosine and jet fuel....do	7,719	6,882	7,339	6,468	4,895
Distillate fuel oil....do	8,945	9,221	10,839	8,639	7,244
Residual fuel oil....do	28,225	31,175	27,945	21,556	20,280
Asphalt and bitumen, refinery....do	915	812	812	596	867
Petroleum coke....do	--------	369	1,155	NA	NA
Total....do	r 52,239	r 55,761	r 55,305	43,517	39,806

• Estimate. r Revised. NA Not available.
[1] Thousand cubic meters.
[2] Includes small quantities of diatomite.
[3] Estimated on basis of 1 cubic meter = 1,300 pounds.

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the Aswan High Dam in late 1968. There were notable increases in production of iron ore, lead and zinc ore, asbestos, and salt; however, output of manganese ore, barite, gypsum, sulfur, and liquefied petroleum gas decreased. Manganese ore declined sharply in 1967 and 1968, owing to the low grade of U.A.R. ore and to depressed prices in the world market.

Data on many mineral commodities produced were not available for 1968; however, the value of some principal commodities were estimated as follows: Crude petroleum, $68.6 million; petroleum products, $132 million; phosphate rock, $10.9 million; iron ore, $3.6 million; and salt, $3.9 million. In 1967 crude petroleum production was valued at $51.9 million; petroleum products, $177.4 million; iron and steel semimanufactures, $55.3 million; phosphate rock, $6.1 million; iron ore, $2.4 million; and salt, $3.6 million.

TRADE

The U.A.R. balance of total commodity trade remained in deficit in 1967; however, the gap between exports and imports narrowed considerably from that of 1966. Trade in mineral commodities contributed significantly to the total trade imbalance although the deficit in mineral commodity trade was considerably smaller than it was in 1966. The principal mineral commodities exported by the U.A.R. in 1967 and their valuation was as follows: Petroleum refinery products, $16.6 million; phosphate rock, $4.9 million; crude petroleum, $4.6 million; and cement, $4.4 million. Little information was available on destinations of mineral exports in 1967; however, cement was shipped mainly to Kuwait (80,331 tons), Yemen (52,850 tons), and Saudi Arabia (50,300 tons). Phosphate rock went principally to Yugoslavia (118,216 tons), mainland China (105,637 tons), and India (73,306 tons). The main mineral commodity imports in 1967 were crude petroleum, (valued at $37.6 million), iron and steel semimanufactures (valued at $30.9 million), and petroleum refinery products (valued at $10.3 million).

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	50	605
1966	48	605
1967	32	566
Imports:		
1965	186	934
1966	195	1,071
1967	115	792

Table 2.—United Arab Republic: Exports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Ilmenite	3,667	2,203
Iron and steel, semimanufactures	226	87
Magnetite	------	955
Manganese ore---thousand tons	122	31
Zircon	395	172
NONMETALS		
Cement---thousand tons	375	353
Fertilizer materials:		
Crude: Phosphate rock thousand tons	371	504
Manufactured:		
Nitrogenous	68,294	12,096
Phosphatic	38,067	34,500
Gypsum, calcined thousand tons	53	39
Salt---do	274	116
Talc and steatite	1,255	1,233
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude thousand 42-gallon barrels	10,629	3,534
Refinery products:		
Gasoline---do	5,085	3,316
Kerosine---do	350	340
Distillate fuel oil---do	r 858	1,475
Residual fuel oil---do	r 6,258	3,683
Liquefied petroleum gas---do	9	4
Asphalt and bitumen---do	87	38
Total---do	r 12,647	8,856

r Revised.

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Table 3.—United Arab Republic: Imports of major mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, all forms	8,590	9,027
Copper, all forms	4,399	702
Iron and steel:		
Scrap	141,703	51,874
Pig iron and ferroalloys	75,060	39,159
Semimanufactures	335,326	208,008
Lead, all forms	4,575	6,237
Silver—thousand troy ounces	r 836	------
Tin, all forms—long tons	491	438
Zinc, all forms	3,526	1,451
Ores, metallic, n.e.s	8	------
Oxides, metallic, mainly for paint	849	212
NONMETALS		
Asbestos	6,817	5,527
Cement—thousand tons	180	78
Clay, mainly kaolin	r 7,913	7,748
Diatomite	1,408	NA
Dolomite and magnesite	2,707	NA
Fertilizer materials:		
Nitrogenous—thousand tons	517	165
Phosphatic—do	r 58	41
Pigments, mineral	r 1,804	1,084
Refractory materials, brick	10,719	4,180
Soda, caustic	25,944	NA
Stone for construction use:		
Marble	311	170
Sulfur:		
Pyrite, unroasted	93,348	75,083
Elemental	39,693	39,423
MINERAL FUELS AND RELATED MATERIALS		
Coal—thousand tons	292	480
Coke—do	5	------
Petroleum:		
Crude thousand 42-gallon barrels	28,604	18,417
Refinery products:		
Gasoline—do	143	95
Kerosine—do	1,099	584
Distillate fuel oil—do	18	264
Residual fuel oil—do	2	8
Lubricants—do	602	422
Other—do	20	10
Total—do	1,884	1,378

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—An expansion of the aluminum sheet and extrusion plant located at Helwan was being planned by engineers from the U.S.S.R.[3] Reportedly this expansion will make the plant the largest in the Near East area.

A bauxite deposit estimated at about 60 million tons of ore was discovered in the Gebel Abu Churuk region of the Eastern Desert of the U.A.R.[4] The deposit reportedly was amenable to open-pit mining and could supply about 200,000 tons of ore per year. Information on the grade of the ore was not available.

Research on low-grade deposits of nepheline syenite in the Abou Khroug area in the Eastern Desert indicated that the ore could be used to produce aluminum.[5] This type of ore has been found also at Kahja, Nakah, and Nagrout. The possibility of supplying the aluminum reduction plant to be constructed at Suez with 400,000 tons

[3] Metal Bulletin (London). No. 5316, July 19, 1968, p. 28.
[4] Metal Bulletin (London). No. 5299, May 17, 1968, p. 24.
[5] U.S. Interests Section, Cairo. State Department Airgram A-52, June 7, 1969, 3 pp.

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per year of the ore from Abou Khroug was being studied.

Iron and Steel.—The U.S.S.R. and the U.A.R. signed a protocol in May for expansion of the steel complex at Helwan which would cost $870 million; $170 million of the total cost would be a credit from the U.S.S.R.[6]

Two new blast furnaces will be added to the existing plant, raising total pig iron capacity to 1.7 million tons per year. The addition of three oxygen converters will raise steelplate output from 300,000 tons to 1.2 million tons. At yearend, a cold sheet mill and a tinplate mill were being erected by U.S.S.R. engineers at the Helwan complex. The expansion of the steelworks, scheduled for completion in 1976, will provide sufficient steel for domestic consumption and also furnish 500,000 tons per year for export. Iron ore for the blast furnaces will be obtained from a deposit located near the Baharia Oasis about 200 miles southwest of Cairo. The U.S.S.R. also will help to develop a mine at this deposit and construct a railway from the mine to the Helwan steelworks near Cairo.

Lead and Zinc.—Geophysical and geological studies completed in the Nasser and Faraby areas reportedly indicated that large deposits of lead and zinc ores may be located in the Om Gheig area on the Red Sea.

Other Metals.—A paper was published that described and located deposits of titanium minerals, beryllium ore, germanium, rare-earth minerals (cerium and lanthanum), yttrium, monazite, thorium oxide, and zirconium silicate in the U.A.R.[7]

NONMETALS

Fertilizer Materials.—A plant for producing 200,000 tons per year of calcium ammonium nitrate was being constructed near Helwan.[8] The plant, owned by El Nasr Coke and Heavy Chemicals Co., will use coke oven gas to produce ammonia which will be converted to the final product.

Phosphate rock deposits on the eastern coast were being developed at a cost of more than $6.75 million.[9] Other projects such as a 595,000-ton phosphate fertilizer plant were planned with financial help from the World Bank. India proposed that it send equipment and personnel to help develop the U.A.R. phosphate rock deposits.[10] It was also proposed that U.A.R. engineers be trained in factories that manufacture equipment for the phosphate industry of India. Reportedly, India could design and manufacture large ore beneficiation plants for the U.A.R.

A series of projects designed to increase the capacities of several phosphate rock mines and plants have been planned by the Egyptian General Organization for Geological Research and Mining. The first project, started in 1967, was to increase production of phosphate concentrate at the Hamrawein mine to 600,000 tons per year. Three thousand laborers and technicians will be employed until 1970 when the project will be completed. The second project involves expansion of phosphate concentrate production at Safaga. Here output is to be raised from 150,000 tons per year of 62-percent phosphate concentrate to 250,000 tons per year of 75-percent phosphate concentrate by 1972 or 1973. This project was expected to employ 3,000 workers and technicians. Expansion of phosphate facilities in the Nile Valley was scheduled to raise present annual output of 350,000 tons to 1 million tons. This project will engage 2,000 workers and technicians. Phosphate deposits at Kosseir also were scheduled for expansion of production capacity to 80,000 tons of phosphate concentrate per year. Work on this project would start in 1974 or 1975 and employ about 3,000 persons. The bulk of output from these mines would be exported.[11]

Gypsum.—Annual agricultural gypsum production in the Ballah area for use on reclaimed land, was to be expanded from 35,000 tons to 175,000 tons a year. Gypsum production for local construction use was scheduled to increase to 20,000 tons per year starting in 1969. Gypsum production in the Alamein area was scheduled at

[6] Iron Age. Soviet Union To Construct Steel Complex in Egypt. V. 201, No. 25, June 20, 1968, p. 23.
[7] Mahgaub, Osman M. The Present Situation With Respect to the New Metals and Minerals. United Nations Economic and Social Council, E/CN.14/MIN./2, Dec. 13, 1967, 6 pp.
[8] Nitrogen, The Journal of World Nitrogen. No. 57, January–February 1969, pp. 9–10.
[9] FDC Israel News Letter. V. 8, No. 12, December 1968, p. 11.
[10] Mining Journal (London). V. 271, No. 6942, p. 169.
[11] Page 2 of work cited in footnote 5.

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15,000 tons per year in 1968 for local construction and export to Libya. About 100 workers and technicians will be employed at the Alamein project.

Limestone.—Surveys were conducted to discover deposits of limestone suitable for use by the aluminum industry. About 4,500 million tons were located in the Beni Khalid area and 2,000 million tons in the Zawyet Sultan area. Geological and mining studies also were carried out in and around Kosseir. At yearend, development work was started in the Abou Shgeila area.

MINERAL FUELS

Petroleum.—The U.A.R. petroleum industry in 1968 continued to progress rapidly with several discovery wells finding new oil deposits. Continuing development and increasing production from previously discovered oilfields provided sufficient supplies for domestic consumption and a sizable surplus for export. The El Morgan field of Pan American U.A.R. Oil Co. and Egyptian General Petroleum Co. (GUPCO) located in the Gulf of Suez produced at steadily increasing rates. At yearend, production averaged 200,000 barrels per day from 27 producing wells completed on 10 platforms. In November, Pan American announced that a new discovery well 10 miles south of El Morgan struck oil indicating a possible new field. Test flows gave 7,500 barrels per day of 25° to 26° API crude oil from about 130 feet of sands of Miocene age at a depth of 6,500 feet. Further drilling was planned to delineate the size of the field. Two exploratory wells were drilled by Pan American in the Western Desert, 60 miles and 140 miles west of Cairo. In early 1968, oil was found at a depth of 1,100 feet near Mamarr el Jimal (Camels Pass). Two noncommercial oil, and two gas, zones were discovered and were being delineated.[12]

In August, Phillips Petroleum Co. and Egyptian General Petroleum Co. (WEPCO) started producing from their field at El Alamein. Reportedly, 20,000 barrels per day was being produced from five wells and pumped to a tanker terminal at El Hamra on the Mediterranean. After several unsuccessful wildcat wells were drilled at Alamein East and West and at Quattâra Rim, Phillips struck oil in a discovery well at Umm Barka, 48 miles south of Mersa Matruh. The well flowed at the rate of 2,088 barrels per day of 45° API oil from a 70-foot-thick Cretaceous sandstone at a depth of about 10,700 feet. Reportedly, the oil was the highest gravity and had the lowest sulfur content of any crude found in the U.A.R. The oil was similar to types of crude found in the large fields of eastern Libya about 230 miles west of the Umm Barka discovery.[13]

In October minor damage occurred to the petroleum refineries at Suez as a result of an artillery exchange between the U.A.R. and Israel armies. This was the second time the refineries were shelled, the first time in late 1967 damage was extensive. The plan to construct a petroleum pipeline from Suez to Alexandria was turned over to a British consulting firm, International Management and Engineering Group (IMEG), for further study prior to asking for bids for construction of the line.[14] Reportedly, a 1-million-barrel-per-day pipeline could be in operation by September 1970. However, there were no indications the U.A.R. Government planned to implement the project.

Employment in the petroleum sector during the year ending June 1968 totaled 28,697 workers compared with 29,057 workers in the previous year, according to the General Egyptian Organization for Petroleum.

Natural Gas.—International Egyptian Oil Co. (IEOC) drilled a third well in the Abu Madi field in the Nile Delta at Al Wastani, about 4 miles from the first two wells. In May the third well struck gas that contained a high content of liquid hydrocarbons. Although the producing horizon differs from the first two wells, total gas reserves in the Abu Madi field were estimated at 3.5 trillion cubic feet. Five other wells drilled in the Nile Delta were dry holes. Three offshore wells, one drilled near Ras el Bar and two near Rosetta, also were dry holes. Pan American U.A.R. Oil Co. discovered a gas and condensate zone near Abu Sennan, south of the Quattâra Depression. The well yielded 4.6 million cubic feet per day from a depth of 6,420 feet.[15]

[12] World Petroleum Report. V. 15, 1969, pp. 96, 98.
[13] World Oil. Phillips Sets More Tests at Egyptian Discovery. V. 168, No. 5, April 1969, p. 103.
[14] Petroleum Economics Limited, Oil Industry Developments. September–October 1968, pp. 226, 227.
[15] Page 96 of work cited in footnote 12.

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The Mineral Industry of the United Kingdom

By Columbus R. Gentile [1] and Edgar L. McGinnis [2]

Problems of the national economy continued to confront the British Government throughout 1968 as added monetary controls, spending restrictions, higher taxes, and other economic measures were invoked to help restrain inflationary pressures and improve the nations balance of payments position. Gross Domestic Product (at factor cost 1963 prices) rose 3 percent in 1968, industrial production increased 4.6 percent, and worker productivity showed a gain of over 6 percent. Despite Government wage control measures, the average wage rate climbed 6.8 percent during the year, more than offsetting a 4.7-percent rise in consumer prices. The devaluation of the British pound produced the desired result of increasing exports but did not stem the tide of imports as expected. On November 27, 1968, the British Government established the import deposit scheme as a means of retarding imports. This scheme requires British importers to deposit with customs, for a period of 6 months, 50 percent of the value of imported goods, except select items specifically exempt. By yearend import deposits amounted to $185 million, but the impact on imports remained as yet undetermined.

The production index for mining and quarrying decreased 4.7 percent in 1968 owing mainly to added cutbacks in coal production. In contrast the metals and nonmetals sector of the mineral industries, and the natural gas and petroleum refining components of the mineral fuels and related industries registered gains in 1968. Major developments of the year in the natural gas sector included the more rapid exploitation of offshore natural gasfields, expansion of the trunk pipeline system, extension of the natural gas grid, added conversions of consumer gas appliances, and agreement between the Gas Council and remaining unsigned producers on the price to be paid for gas from offshore fields. In the petroleum sector, expansion of refinery capacity, pipelines, storage, and other related facilities continued at a rapid pace to meet the growing need for petroleum products in internal and foreign markets. Oil and natural gas exploration continued at a high level throughout 1968 with new natural gas strikes reported, in offshore and onshore areas, several of which have a potential for commercial development and exploitation. No significant new oil finds were reported.

Both oil and natural gas continued to make inroads on coal markets and to provide an increasing share of the nation's energy needs. Meanwhile rationalization measures in the coal industry were actively pursued in an effort to improve operations and reduce costs. Worker productivity again registered an increase and mechanization of operations made notable advances, approaching optimum in several mining areas with respect to cutting and loading activities. The industry was encouraged by the news that a large cement plant was switching from use of oil to coal, and that several new coal-burning electric power complexes were to be built, including a sizable plant at the site of one of the new aluminum smelters now under construction.

Production of iron and steel increased in 1968 as the industry completed its first calendar year as a renationalized entity. Nevertheless there was an operating loss for the year, and problems of reorganiza-

[1] Supervisory mineral specialist, Division of International Activities.
[2] International economist, Division of International Activities.

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tion, prices, and labor remained to be resolved. Work was initiated on two of the three new aluminum smelters to be built in the United Kingdom. Construction of the third unit is scheduled to be started late in 1969. Plans for the initial development of United Kingdom's potash deposits were advanced as work was initiated on the first of three new mines and associated facilities to be built. Combined production capacity of the three units will be adequate to meet total internal demand and also provide large excess tonnages for export. Exploration for indigenous sources of tin, lead, zinc, and other minerals was stepped up during the year with as yet, only limited success. A new tin mine, the nation's third, is being developed and prospects are reported promising for development of possibly two more.

PRODUCTION

Reflecting the growth of the national economy in 1968, the metal, nonmetallic, and the refined products and natural gas components of the mineral fuels sector virtually all registered significant production gains as compared with 1967 levels. The metals sector featured increases in mine output of tin ores (almost 22 percent in metal content), slab zinc (38 percent) and refined lead, copper, and aluminum ingots (22, 17, and 4 percent, respectively). In addition, output of iron ore, pig iron, and steel ingots including castings, each rose by roughly 8 percent. Among the nonmetallic mineral commodities, manufactured fertilizers registered significant production gains with the nitrogenous group up some 21 percent, phosphates 11 percent, and other compounds 5 percent. Gains in production in 1968 were also attained in the case of barite, cement, and clays. Natural gas and petroleum products remained, by far, the major components of the mineral fuels sector. Gross production of natural gas at 71.3 billion cubic feet in 1968 was more than four times total output for 1967 as gathering and distribution facilities were extended and demand for natural gas at home and abroad increased significantly. At the same time output of refined petroleum products rose some 13 percent in 1968 with nearly all products showing substantial increases over 1967 levels. Distillate and residual fuel oils remained the major products produced accounting for almost 62 percent of total refinery output in 1968. In contrast output of crude oil fell 6.8 percent in 1968 and continued to provide only a relatively small proportion of total national needs. Coal output declined 8.2 million metric tons or 4.7 percent in 1968 as market losses to natural gas and petroleum fuels continued. Total coke production was down 3.9 percent in 1968, with output of coke-oven coke up more than 6 percent and gas coke down over 26 percent, owing largely to closing of manufactured gas plants and increased substitution of oil for coal in gas production.

Table 1.—United Kingdom: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Primary	32	36	37	39	38
Secondary	172	178	184	179	188
Cadmium metal—metric tons	197	r 221	r 184	209	207
Copper:[1] Refined:					
Primary (from imported blister only)	106	108	44	36	50
Secondary	119	125	136	133	148
Iron and steel:					
Iron ore (27 percent Fe)	16,588	15,662	13,877	12,944	13,948
Pig iron (including blast furnace ferroalloys)	17,551	17,740	15,962	15,395	16,695
Steel ingots and castings	26,651	27,444	24,705	24,276	26,274
Steel semimanufactures:					
Blooms, billets and slabs	11,884	12,229	10,889	11,284	NA
Sheet bars and tinplate bars	6,172	6,684	6,692	6,527	NA

See footnotes at end of table.

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Table 1.—United Kingdom: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS—Continued					
Lead:					
Mine output, metal content-metric tons	180	92	---	---	---
Metal:[2]					
Primary	25	23	16	27	32
Secondary	180	172	175	192	236
Magnesium metal, including secondary	5	5	4	4	NA
Nickel metal, including secondary	38	40	37	39	NA
Tin:					
Mine output, metal content—long tons	1,226	1,313	1,272	1,475	1,798
Metal:					
Primary—thousand long tons	17	16	17	28	25
Secondary—do	2	2	1	8	8
Zinc, slab	111	107	101	104	143
NONMETALS					
Barite and witherite	r 43	r 38	r 36	37	• 40
Calcite	25	24	24	17	29
Cement	16,966	r 16,971	r 16,787	17,609	17,820
Chalk	18,556	18,803	r 19,350	18,227	18,938
Chert and flint	142	138	r 131	116	139
Clays:					
China clay	r 2,033	r 2,203	r 2,482	2,591	2,809
Fire clay	1,923	1,900	r 1,977	1,741	1,758
Potters and ball clays	626	647	r 510	497	740
Other clays and shale	34,675	35,056	r 34,208	35,339	39,665
Diatomite	14	15	15	13	NA
Feldspar (china stone)	58	30	30	31	• 31
Fertilizer materials:[3] Manufactured:					
Nitrogenous, N content	562	598	665	733	889
Phosphatic, P_2O_5 content	429	444	427	416	463
Other compounds, gross weight	2,909	2,769	2,754	2,846	2,982
Fluorspar [4]	r 110	r 131	r 155	154	198
Gypsum and anhydrite	4,587	4,455	r 4,326	4,593	4,789
Igneous rock and perlite	23,314	25,213	r 28,711	32,326	36,181
Salt:					
Rock	704	735	1,047	703	1,045
Brine	1,369	1,451	1,478	1,413	1,501
Other [5]	4,672	4,814	4,808	4,997	5,131
Slate	123	102	r 85	88	78
Stone, sand and gravel:					
Dimension stone:					
Limestone	57,996	60,548	r 67,846	76,579	84,141
Sandstone	6,927	r 7,383	r 8,109	9,144	10,612
Sand and gravel:					
Sand for glassmaking	1,418	1,390	1,462	1,453	1,529
Other silica sand	736	1,079	968	1,138	NA
Moulding and pig-bed sand	908	843	r 815	762	644
Other industrial sand and gravel	104,462	r 102,081	r 104,165	107,723	107,595
Strontium minerals	17	10	10	7	• 11
Sulfur, elemental including sulfur recovered from petroleum refineries	55	49	41	47	• 50
Talc, includes steatite and pyrophyllite	10	10	r 9	9	• 10
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	153	160	166	163	184
Coal:					
Anthracite	4,672	4,270	4,523	4,112	• 4,200
Bituminous	192,068	r 186,229	172,853	170,787	162,512
Coke and coke breeze:					
Coke oven coke	17,220	17,381	16,376	15,565	16,586
Gashouse coke	8,942	7,893	7,317	6,287	4,649
Coke breeze, total	3,620	3,430	3,211	2,946	2,651
Fuel briquets, all grades	1,351	r 922	951	r 974	1,040
Gas:					
Manufactured, all types, gross production million therms [6]	6,807	6,906	6,901	6,911	NA
Natural, gross production million cubic feet	200	449	123	16,664	71,885
Petroleum:					
Crude oil	129	83	78	88	82
Refinery products:					
Gasoline:					
Aviation and wide cut	1,013	758	630	456	437
Motor	7,783	8,824	8,816	8,964	9,529
Kerosine and jet fuel	3,220	3,429	3,852	4,044	4,726
Gas and diesel fuel oils	12,185	13,638	14,898	14,229	17,144
Residual fuel oil	23,176	26,288	29,128	30,767	34,258

See footnotes at end of table.

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Table 1.—United Kingdom: Production of mineral commodities—Continued

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
MINERAL FUELS AND RELATED MATERIALS —Continued					
Petroleum—Continued					
Refinery products—Continued					
Liquid petroleum gases	1,228	1,419	1,629	1,655	1,684
White spirit and industrial	166	154	175	156	251
Naphtha and other feedstock	2,967	3,688	4,044	4,543	5,918
Lubricating oils	1,053	1,017	1,090	1,011	1,085
Paraffin	60	54	58	57	57
Bitumen	1,482	1,445	1,601	1,750	1,758
Refinery fuel and losses	4,840	5,208	5,410	5,565	6,051
Other, including unspecified	245	192	388	331	308
Total	59,418	66,109	71,719	73,528	83,096

e Estimate. p Preliminary. r Revised. NA Not available.
[1] Includes copper from imported blister.
[2] Includes lead refined from imported bullion.
[3] Year ended May 31.
[4] Includes recovery from old mine and zinc dumps.
[5] Salt in brine other than for salt making.
[6] 1 therm =100,000 British thermal units.

TRADE

The deficit trade balance of the United Kingdom continued to widen in 1968, the first calendar year of performance since the 14.3-percent devaluation of the pound sterling. Inability to curb rising imports was largely responsible for the imposition of added restrictive measures, such as the import deposit scheme, during the latter part of 1968. Mineral commodities as a group contributed significantly to the adverse trade balance of the United Kingdom as indicated in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:[1]		
1966	2,319	14,118
1967 r	2,342	13,861
1968 p	2,609	14,822
Imports:		
1966	4,541	16,671
1967 r	4,859	17,714
1968 p	5,598	18,958

p Preliminary. r Revised.
[1] Excludes reexports.

Major mineral commodity exports in 1967, on a dollar value basis, included iron and steel products (27 percent), nonferrous metals (24.3 percent), precious and semiprecious stones (23 percent), and petroleum products (13.5 percent). Exports of iron and steel products rose in value by 5 percent to $632 million, and nonferrous metal exports increased over 6 percent to $569 million. In contrast the export dollar value of precious and semiprecious stones and petroleum products declined 5.7 percent and 1.2 percent, respectively.

Mineral exports of the United Kingdom in 1967 moved mainly to Western Europe (51 percent) with countries of the European Economic Community (EEC) accounting for 25.5 percent, nations of the European Free Trade Association (EFTA) 17 percent, and other European countries, 8.5 percent. The United States remained the largest single market for British exports, accounting for over 15 percent of the total dollar value of exports.

The most important categories of mineral commodity imports in 1967 (dollar value basis) were petroleum and refinery products (40.5 percent), nonferrous metals (21.5 percent), precious and semiprecious stones (12.3 percent), and metalliferous ores and scrap (11.5 percent). Imports of petroleum and products increased almost 15 percent to $1,970 million, of precious and semiprecious stones over 11 percent to $599 million, and of metalliferous ores and scrap nearly 9 percent to $558 million. In contrast imports of nonferrous metals at $1,046 million were down over 11 percent.

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Table 2.—United Kingdom: Exports[1] of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Oxide and hydroxide	13,294	22,191	Poland 14,965; Norway 2,399.
Metal, including alloys:			
Unwrought	26,031	22,224	United States 4,547; East Germany 4,464; West Germany 3,249.
Semimanufactures	45,903	38,054	Ireland 3,174; Sweden 2,376.
Antimony metal, including alloys, all forms	763	NA	
Bismuth metal, including alloys, all forms	330	379	NA.
Chrome oxide and hydroxide	1,551	656	NA.
Cobalt oxide and hydroxide	468	195	Japan 38; Belgium-Luxembourg 27; Australia 25.
Copper metal, including alloys:			
Unwrought	92,061	115,123	West Germany 32,714; Italy 21,111.
Semimanufactures	84,892	71,937	United States 8,964.
Gold metal, unworked or partly worked:			
Bullion, refined—thousand troy ounces	36,952	60,360	NA.
Leaf gold—do	48	125	NA.
Gold coin—do	1,447	1,006	NA.
Iron and steel:			
Metal:			
Scrap—thousand tons	250	1,134	Mainland China 324; Italy 269; Spain 213.
Pig iron, ferroalloys and similar materials—do	88	176	Japan 73; Belgium-Luxembourg 18.
Steel, primary forms—do	212	392	Spain 104; Japan 73; United States 67.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod—thousand tons	72	111	Mainland China 34; United States 32.
Other bars and rod—do	271	268	United States 52; India 29.
Angles, shapes, sections:			
Heavy, including sheet piling—do	283	306	United States 138.
Light—do	49	37	United States 6; Ireland 4.
Universals, plates and sheets:			
Universals and heavy plates, uncoated—do	253	395	United States 95; mainland China 40.
Medium plates and sheets, uncoated—do	89	109	Mainland China 25; United States 20; Sweden 14.
Light plates and sheets, uncoated—do	975	929	United States 247; Sweden 103.
Tinned plates and sheets, coated—do	375	401	Republic of South Africa 98; Spain 48.
Other coated plates and sheets—do	215	256	Finland 39; Norway 30; Sweden 26.
Hoop and strip—do	98	105	Canada 14; India 11; Sweden 9.
Rails and accessories—do	170	162	Italy 40; Mexico 25.
Wire—do	104	101	United States 20; Canada 16.
Tubes, pipes and fittings—do	445	378	Canada 37; Netherlands 28.
Castings and forgings, rough—do	34	20	Sweden 6; United States 3; Canada 3.
Lead:			
Oxides	4,835	5,207	Ireland 849; Sweden 823; Norway 583.
Metal, including alloys:			
Unwrought	43,901	72,134	West Germany 24,203; United States 15,778; Netherlands 10,289.
Semimanufactures	1,794	1,930	United States 141.
Magnesium metal, including alloys, all forms	1,233	1,139	United States 373; France 295.
Nickel metal, including alloys:			
Unwrought	25,688	30,714	West Germany 12,032; France 4,672; Sweden 4,217; Italy 3,422.
Semimanufactures	8,156	9,633	United States 1,371; France 1,231.
Platinum-group metals and silver: Metals, including alloys:			
Platinum-group—thousand troy ounces	963	1,101	NA.
Silver—do	26,984	24,564	NA.
Tin:			
Oxides—long tons	r 368	286	Spain 77; Mexico 42; Brazil 31.
Metals, including alloys:			
Unwrought—do	r 9,578	12,406	U.S.S.R. 3,000; United States 1,659.
Semimanufactures—do	r 598	771	Norway 337; West Germany 209.
Zinc:			
Oxides	4,358	3,507	Ireland 387.
Metal, including alloys:			
Unwrought	1,117	10,520	Portugal 1,846; Brazil 1,318.
Semimanufactures	5,024	4,420	Netherlands 620; Ireland 488.
Other:			
Ore and concentrate	16,968	15,157	Spain 4,838; Belgium-Luxembourg 4,022; Netherlands 1,996; West Germany 1,854.
Ash and residues containing nonferrous metals	48,047	34,575	Canada 8,500; Belgium-Luxembourg 7,541; West Germany 7,026.

See footnotes at end of table.

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Table 2.—United Kingdom: Exports[1] of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS			
Abrasives, natural, n.e.s	3,607	4,802	Spain 1,011; United States 400.
Asbestos:			
Crude or simply processed	4,770	4,315	West Germany 393; Sweden 381.
Asbestos cement products	33,858	32,010	Hong Kong 2,085.
Cement, thousand tons	250	332	Ghana 108; Ivory Coast 68.
Clays and clay products (including all refractory brick):			
Crude clays, including china clay and others, thousand tons	2,135	2,145	NA.
Products:			
Refractory (including nonclay bricks), do	147	151	Netherlands 19; Sweden 18.
Nonrefractory, do	71	59	Australia 10; United States 9; Canada 7.
Fertilizer materials, manufactured:			
Nitrogenous, do	362	373	Mainland China 62; Ceylon 46; India 42.
Phosphatic, do	45	56	West Germany 36; Ireland 19.
Other, including potassic, do	55	77	Ireland 56.
Lime	33,340	34,012	Nigeria 5,753.
Salt, thousand tons	454	421	Sweden 145; Nigeria 92.
Stone, sand and gravel, do	262	670	France 199; Netherlands 190.
Strontium (celestite)	7,501	NA	
Other nonmetals, n.e.s.:			
Crude, including quartz, mica and feldspar, thousand tons	r 282	340	Norway 218; Sweden 34.
Slag, dross and similar waste, not metal bearing, do	292	207	West Germany 171.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	6,162	6,735	Norway 843; Sweden 795.
Carbon black	35,899	31,728	NA.
Coal, all grades, including briquets, thousand tons	2,827	1,882	France 546; West Germany 344; Italy 228.
Coke, do	984	773	Norway 445; Sweden 113.
Gas, natural and manufactured, do	14	12	Ireland 6; Spain 4.
Petroleum:			
Crude and partly refined, do	127	192	East Germany 98; Netherlands 50; Finland 29.
Refinery products:			
Gasoline (including natural), do	1,542	1,458	Sweden 388; Denmark 282; Norway 195; Canada 188.
Kerosine and jet fuel, do	889	917	Ireland 220; Sweden 145; Denmark 136.
Distillate fuel oil, do	4,037	3,870	Denmark 920; Netherlands 575.
Residual fuel oil, do	4,829	4,645	United States 656; Norway 641.
Lubricants, do	578	544	Sweden 47; Republic of South Africa 42.
Mineral jelly and wax	4,573	4,656	Portugal 871; Ireland 646.
Other, including bitumen and other residues, thousand tons	279	241	Norway 75; France 42; Canada 34; Ireland 28.

r Revised. NA Not available.
[1] Excludes reexports.

Countries of West Europe (26.7 percent), the Middle East (22.2 percent), Africa (18 percent), and North America (15.4 percent) were the principal sources of supply. The five major individual country suppliers of mineral commodities on the basis of dollar value included Canada (9.5 percent), Iran (7.4 percent), Republic of South Africa 6.9 percent), United States 5.9 percent), and the Netherlands (5.3 percent).

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Table 3.—United Kingdom: Reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum metal, including alloys, all forms	340	838	Italy 501; Hong Kong 305.
Copper metal, including alloys, all forms	4,245	3,489	United States 1,396; West Germany 1,018; Netherlands 974.
Lead metal, including alloys, all forms	485	3,381	Mainland China 2,542; Italy 583.
Mercury 76-pound flasks	5,337	3,162	Japan 406; Netherlands 377.
Nickel metal, including alloys:			
Unwrought	14,566	5,539	Italy 1,516; West Germany 1,446; Sweden 807.
Semimanufactures	963	478	Italy 126; Sweden 102; France 57.
Tin metal, including alloys, all forms long tons	89	23	Ireland 10; Uruguay 4; Argentina 4.
Zinc metal, including alloys, all forms	5,012	96	Ireland 88.
NONMETALS			
Asbestos	131	113	West Germany 73.
Fertilizer materials, manufactured	1,016	577	New Zealand 300.
Talc, steatite, soapstone, and pyrophyllite	716	208	Ireland 101.
Other nonmetals, quartz, mica, and feldspar	3,710	3,601	West Germany 1,000; Netherlands 594.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline (including natural)	3,162	6,645	West Germany 4,036; Ireland 1,638.
Kerosine and jet fuel	1,180	4,261	Denmark 2,032; Ireland 1,219.
Distillate fuel oil	5,082	6,375	Denmark 5,054; Ireland 1,321.
Residual fuel oil	1,626	10,870	Ireland 10,780.
Lubricants	213	143	Ireland 40.
Mineral jelly and wax	72	41	Mainly to West Europe.

Table 4.—United Kingdom: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate thousand tons	492	459	Ghana 273; Greece 92; France 50.
Metal, including alloys:			
Scrap do	16	14	U.S.S.R. 8; East Germany 1.
Unwrought do	346	308	Canada 123; Norway 106.
Semimanufactures do	29	31	Belgium-Luxembourg 7; Ireland 4; Austria 3.
Bismuth metal, including alloys:			
Metal	376	340	NA.
Alloys	152	266	NA.
Cadmium metal, including alloys, all forms	1,052	1,097	NA.
Chromite thousand tons	201	100	Republic of South Africa 62; Philippines 34.
Cobalt:			
Oxide and hydroxide	1,120	954	Canada 931.
Metal, including alloys, all forms	1,607	1,635	NA.
Copper:			
Ore and concentrate	463	52	United States 28.
Metal, including alloys:			
Scrap	5,145	2,036	Ireland 758.
Unwrought:			
Refined (blister) thousand tons	37	31	Chile 30.
Unrefined do	474	420	Zambia 173; Canada 88.
Semimanufactures	6,425	7,255	Canada 2,194; West Germany 1,214; United States 729.
Gold:			
Ore and concentrate thousand troy ounces	5,000	NA	
Metal, unworked and partly worked:			
Refined do	25,839	33,735	NA.
Unrefined do	764	821	NA.
Iron and steel:			
Ore and concentrate, except roasted pyrite thousand tons	15,810	15,781	Sweden 3,494; Canada 3,131; Liberia 1,722; Mauritania 1,658.
Roasted pyrite do	407	557	Italy 176; Sweden 153; Spain 146.
Metal:			
Scrap do	5	3	Ireland 2; West Germany 1.
Pig iron, including cast iron, sponge iron, powder and shot do	403	284	Finland 102; Norway 70; U.S.S.R. 36.

See footnotes at end of table.

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Table 4.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Iron and steel—Continued			
Metal—Continued			
Ferroalloys:			
Ferromanganese-thousand tons	77	75	Republic of South Africa 40; Norway 21; France 8.
Other-do	189	180	Norway 81; Canada 23.
Steel, primary forms-do	122	309	Spain 114; U.S.S.R. 62.
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod-thousand tons	61	148	Belgium-Luxembourg 37; France 25; Sweden 24; Norway 22.
Other bars and rod-do	160	352	Sweden 107; Norway 78; Netherlands 49; France 41.
Angles, shapes, sections-do	28	34	Belgium-Luxembourg 16; West Germany 6; France 3.
Universals, plates and sheets:			
Heavy and medium plates and sheets uncoated.-do	46	99	Sweden 23; Poland 16; Austria 14; Australia 14.
Light plates and sheets, uncoated.-thousand tons	339	384	Netherlands 97; Belgium-Luxembourg 76; West Germany 41.
Other coated plates and sheets.-do	39	76	Canada 31; Belgium-Luxembourg 19; Japan 7.
Hoop and strip-do	26	39	Belgium-Luxembourg 14; Canada 6; West Germany 5.
Wire-do	6	7	Sweden 3; Norway 1.
Tubes, pipes, and fittings-do	80	204	Italy 80; West Germany 33; Sweden 30; France 26.
Castings and forgings (rough)-do	3	2	Mainly from West Europe.
Lead:			
Ore and concentrates-do	22	33	Australia 12; Canada 11; Norway 6; Peru 4.
Metal, including alloys:			
Scrap	2,866	2,705	West Germany 527; Belgium-Luxembourg 460; Netherlands 359; East Germany 358.
Unwrought and semimanufactures	208	188	Australia 122; Canada 49.
Magnesium metal, including alloys:			
Scrap	215	67	Japan 41.
Unwrought and semimanufactures	5,257	6,284	Norway 3,053; Canada 2,221.
Manganese ore and concentrates-thousand tons	371	411	India 59; Brazil 44.
Mercury-76-pound flasks	20,335	17,637	Italy 8,848; United States 2,698; Spain 2,495.
Nickel:			
Matte, speiss, and similar materials	58,966	59,528	Canada 59,381.
Metal, including alloys:			
Scrap	2,939	4,646	United States 1,894; Netherlands 936; West Germany 809.
Unwrought	39,067	29,900	Canada 16,853; U.S.S.R. 7,388; Norway 4,240.
Semimanufactures	2,712	1,665	United States 1,126.
Platinum-group metals, including alloys, all forms.-thousand troy ounces	135	130	NA.
Selenium, elemental	193	141	NA.
Silicon, elemental	11,586	11,263	NA.
Silver:			
Ore and concentrate	357	------	
Metal, including alloys.-thousand troy ounces	54,834	63,802	NA.
Tin:			
Ore and concentrate-long tons	55,708	62,806	Bolivia 56,163.
Metal, including alloys:			
Scrap-do	r 821	995	Netherlands 314; West Germany 149; United States 106.
Unwrought and semimanufactures.-do	r 10,131	8,221	Nigeria 6,258.
Tungsten ore and concentrate	7,529	6,250	Bolivia 2,238; mainland China 1,118.
Zinc:			
Ore and concentrate-thousand tons	239	262	Australia 157; Canada 54.
Metal, including alloys:			
Scrap	1,233	3,966	Netherlands 1,125; West Germany 898; Norway 531; Sweden 510.
Unwrought and semimanufactures.-thousand tons	187	165	Canada 111.

See footnotes at end of table.

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Table 4.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Other:			
Ore and concentrate, including titanium and zirconium.	329	322	Canada 52.
Ash and residues containing nonferrous metals.	70	92	Canada 52; Italy 9.
Base metals, including tungsten, molybdenum, and tantalum.	12,790	13,910	Norway 3,055; Canada 2,845; Republic of South Africa 1,512; Zambia 1,472.
NONMETALS			
Abrasives, natural: Pumice, emery, natural corundum, etc. thousand tons	65	103	Italy 40; Denmark 39.
Asbestos:			
Crude do	194	171	Canada 100; Republic of South Africa 65.
Asbestos cement products do	30	30	Belgium-Luxembourg 14; France 4.
Barite and witherite do	58	52	Morocco 12; mainland China 11.
Boron materials:			
Crude natural borates do	43	53	Netherlands 43; Turkey 8.
Oxide and acid do	5	6	Mainly from France.
Cement do	414	364	Ireland 361.
Chalk	660	------	
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s do	114	99	United States 42; Republic of South Africa 36.
Products:			
Refractory (including nonclay bricks). do	63	54	Ireland 15; Austria 15; Denmark 9.
Nonrefractory do	14	19	Japan 5; Belgium-Luxembourg 4; West Germany 3.
Cryolite and chiolite	2,478	1,558	All from Denmark.
Diatomite and other infusorial earths. thousand tons	43	47	NA.
Feldspar and fluorspar do	117	112	Norway 73; Finland 17.
Fertilizer materials:			
Crude:			
Nitrogenous thousand tons	19	14	All from Chile.
Phosphatic do	1,665	1,616	Morocco 878; United States 309.
Potassic do	36	43	East Germany 31; West Germany 10.
Other do	17	23	Ireland 20.
Manufactured:			
Nitrogenous do	183	396	West Germany 133; Netherlands 133.
Phosphatic do	46	91	Belgium-Luxembourg 40; Netherlands 31; France 13.
Potassic do	688	768	Canada 225; East Germany 208; France 136.
Other, including mixed do	161	285	Netherlands 261.
Graphite, natural	10,263	8,638	Madagascar 2,980; Ceylon 2,341.
Gypsums and plasters thousand tons	150	146	Ireland 111; France 33.
Magnesite do	111	62	Greece 23; Spain 8.
Mica, crude, including splittings and waste. do	10	9	Republic of South Africa 5; India 2.
Pigments mineral, natural, crude	5,303	5,277	Cyprus 1,646; Republic of South Africa 1,571.
Pyrites (gross weight) do	268	251	Cyprus 105; U.S.S.R. 55; Sweden 40.
Salt do	62	37	West Germany 25; Poland 5.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked do	34	34	Italy 21; Sweden 5.
Worked do	21	28	Portugal 19; Italy 3; India 2.
Dolomite do	20	22	Norway 12; Spain 8.
Gravel and crushed rock do	149	183	Ireland 103; France 25.
Quartz and quarzite do	14	9	Norway 4; Sweden 1.
Sand, excluding metal bearing do	246	204	Belgium-Luxembourg 167; Netherlands 30.
Sulfur, elemental do	768	731	Mexico 299; France 264; United States 157.
Talc, steatite, soapstone and pyrophyllite. do	49	51	Norway 23; France 10.
Other nonmetals, n.e.s.:			
Crude do	r 309	310	Italy 67; Netherlands 44; Norway 33.
Slag, dross and similar waste, not metal bearing. do	42	25	Sweden 11; Ireland 7.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural thousand tons	79	69	Trinidad and Tobago 38; France 18.
Carbon black do	12	12	United States 8; East Germany 1.
Coal and coke, including briquets do	87	70	Ireland 65.

See footnotes at end of table.

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Table 4.—United Kingdom: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS			
Gas, natural and manufactured ----------thousand tons----	855	977	Algeria 607; Netherlands 105.
Petroleum :			
Crude and partly refined----------do----	71,489	74,641	Iran 17,054; Kuwait 12,014; Libya 10,751; Saudi Arabia 10,348
Refinery products:			
Gasoline (including natural)---do----	r 3,700	4,799	Netherlands 1,172; Italy 657.
Kerosine and jet fuel----------do----	4,014	5,390	Italy 1,028; Netherlands 930; France 540.
Distillate fuel oil----------do----	3,806	4,478	Italy 1,518; Netherlands 506.
Residual fuel oil----------do----	9,520	8,607	Netherlands 2,432; France 1,648; Italy 1,564.
Lubricants----------do----	612	650	Netherlands Antilles 168; United States 155; Netherlands 90.
Mineral jelly and wax----------do----	116	201	Netherlands Antilles 134; Venezuela 29.
Other, including petroleum coke. do----	95	85	United States 45; Netherlands 21.

r Revised. NA Not available.

COMMODITY REVIEW

METALS

Aluminum.—Work moved ahead rapidly on the construction of three aluminum smelters with a combined initial aluminum production capacity of 260,000 tons yearly, following government approval of the projects in 1968. The facilities approved include the British Aluminum Company (BACO) plant at Invergordon, the Alcan Aluminium Ltd. plant at Lynemouth, Northumberland, and the Anglesey Aluminum, Ltd. (60 percent Rio Tinto Zinc (RTZ) and British Insulated Callenders Cable, Ltd. (BICC), and 40 percent Kaiser Aluminum and Chemical Company) facility near Holyhead, Anglesey. The BACO and Anglesey Aluminum plants to be completed in 1971 will each have an initial yearly capacity of 100,000 tons. Both these plants will use electric power from nuclear stations near the smelter sites. The Alcan smelter will have a capacity of 60,000 tons yearly and utilize electric power from a company owned coal-fired station to be constructed at the plant site. In all cases, company plans provide for expansion of facilities when market conditions permit. The Government has agreed to review expansion plans with Norway and other European Free Trade Association countries before granting approval.

Small domestic primary output (1968—38,200 metric tons) obtained from BACO facilities at Fort Williams and Kinlochleven, Scotland, represented only about 10 percent of virgin aluminum consumption in 1968. The remaining 90 percent was imported, principally from Canada and Norway.

Copper, Lead, and Zinc.—The 37-percent rise in output of slab zinc in 1968 was mainly due to processing of increased tonnages of ore at the newly opened (December 1967) Avonmouth No. 4 smelter of Imperial Smelting Company (a subsidiary of Rio Tinto Zinc). The new smelter has a rated annual capacity of 90,000 tons, which can be increased to 140,000 tons with the addition of special units.

The search for minerals continued through 1968. A Canadian company, New Davies Petroleum, initiated exploration drilling in the old mining area of Strontian in Scotland formerly mined for lead, zinc, and silver. In Wales, Andrex Mining is investigating the old lead-silver deposits in the north of Aberystwyth, and in Anglesey, Canadian International Gas and Oil is prospecting the former Parys and Inona copper mines. A subsidiary company of Chartered Consolidated has initiated studies of mineral deposits in the Minera-Llanarmon district.

Green and Associates of Canada are investigating lead-zinc-silver deposits in an old mine at Braithwaite, near Keswick, reported to contain 40,000 tons of ore.

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Iron and Steel.—Stimulated by improved economic conditions and expansion of the national economy, the iron and steel sector in 1968 registered its best performance since 1965. Production of iron ore, pig iron, and steel all increased sharply and the values of iron and steel imports and exports in 1968 were also higher than in 1967.

The British Steel Corporation (BSC), established subsequent to the nationalization of 14 major private companies in July 1967, completed its first calendar year of operation in 1968, producing almost 24 million metric tons of steel ingots or over 90 percent of national output. The corporation, nontheless, had an operating loss of some $28.8 million for the year and was still confronted with pricing and organizational problems. A 5-percent increase in price of selected products in 1968 was expected to move the corporation to a profit-making position for the year. At the same time plans were announced for rationalization and modernization of the industry designed to raise output to between 30 and 35 million tons by 1975, and reduce manpower by 50,000 or some 25 percent below the level at the close of 1968. To accomplish this, expenditures of $360 to $420 million yearly, over the next 6 years are contemplated.

Late in 1968 a new division was established by BSC to handle overseas marketing for wide strip mill products. There are two sections, one handling sheet and the other dealing with tinplate products. The new arrangement will result in a single export marketing policy and eliminate quotations for the same orders by separate units of the corporation. Meanwhile, a reorganization plan is under consideration to replace the present multiproduct group organization with a smaller number of divisions based on products (product-based organizations).

Tin.—Exploration and prospecting for tin deposits including further study of old abandoned workings continued throughout 1968 and the first half of 1969. Mine output of tin increased almost 22 percent in 1968, attaining the highest level since 1938 when 2,010 tons was produced. In May 1969 Consolidated Gold Fields, Limited, announced plans for the development of a new tin mine at Wheal Jane, 3 miles south of Truro. The $14.4 million underground mine, scheduled to start operations in the latter half of 1971, will have an initial annual output of 150,000 tons of ore. Ore reserves estimated at 5 million tons, are reported to contain 1.25 percent tin. Prado Exploration Ltd., prospecting in the area of the old Wellington mine near the Consolidated Gold Fields prospective mine, is seeking a partner to share financial burden of sinking an exploration shaft. Drilling tests are reported to indicate tin-bearing ore at a depth of 1,200 feet sampling 1 percent tin with some copper and zinc.

Camborne Tin Mines Limited, the consortium of Union Corporation (U.K.) Ltd., Guggenheim Exploration of Cornwall Inc., Tehidy Minerals, and Pacific Tin Consolidated Corporation, sinking a prospect shaft at Pendarves near Camborne, Cornwall, reached a depth of 850 feet and completed the No. 4 preparation level. Underground tunnels to reach proven tin seams are to be completed by yearend 1969, at which time a decision will be made for deepening the shaft and extending exploration and development work to acquire adequate information on available reserves.

Consolidated Tin Smelters is building a new tin smelting plant and secondary metal works at Kirby, Liverpool. The plant, whose initial cost is estimated at $7.3 million, is designed for the treatment of different grades of tin concentrate and secondary materials.

Tin dredging operations at St. Ives Bay in Cornwall have been discontinued by Costal Prospecting Ltd., a subsidiary of Union Corporation (U.K.) Ltd., because of unprofitable results.

Meanwhile two established tin producers, Geevor Tin Mines Limited and South Crofty Limited, have initiated plans to expand production capacity. South Crofty's production is to be doubled to reach 200,000 tons of ore annually by 1971. Planned expenditures of over $1.5 million will be mainly for underground development to block out sufficient reserves to meet increased production rate, and for added hoisting and processing plant capacity. Geevor Tin Mines has been steadily increasing output and by early 1969 was producing tin metal at a rate of over 1,000 tons per year. The company announced an undersea break in the Levant mine was successfully sealed after 8 years of work and that prospects of reopening the mine were promising. Despite these projects and

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exploration activity being carried out elsewhere in Cornwall, including the examination of offshore prospects, total output of tin in the United Kingdom is likely to remain small by world standards and imports of tin-in-concentrates will continue to be sizable.

Uranium.—The Institute of Geological Sciences is prospecting for uranium ore on behalf of the United Kingdom Atomic Energy Authority, with initial efforts concentrated in select areas of North Scotland and the Midlands.

NONMETALS

Cement.—Production capacity of the Portland Cement Company in Northern Ireland was increased to 650,000 tons yearly, following the opening late in 1968 of a new 300,000-ton-per-year cement plant at Cookstown in County Tyrone.

Potash.—Early in 1969, Cleveland Potash, Ltd. (a joint venture of Charter Consolidated and Imperial Chemical Company), initiated construction of the United Kingdom's first potash mine. The new facility, to be located at Boulby, near Staithes in North Yorkshire, will cost an estimated $60 million to $72 million, and produce at the rate of 1.0 to 1.5 million tons yearly, beginning in 1973. Thick deposits found at depths of 3,500 to 4,000 feet will be reached by shaft, and mined by conventional methods. Two other companies also have plans for the construction of potash mines and associated facilities. Yorkshire Potash, Ltd., a subsidiary of Rio Tinto Zinc expects the local government to approve construction of a potash mine at Hawkser, about 15 miles southeast of the Cleveland Potash, Ltd., location. Plans provide for a 1-million-ton-per-year producing operation to be completed about 5 years after work is started. Cost of the project is estimated at $60 million to $70 million. Plans for a third potash producing operation were revealed when Whitby Potash, Ltd. (a joint unit of Armour and Company and the Shell Group), sought permission of local authorities to build a 450,000-ton-per-year, potash solution mining facility near Whitby in North Yorkshire.

The combined annual productive capacity of the three planned units far exceeds the 753,000 tons of potash imported in 1968 to meet national requirements. It will be necessary to develop a sizable foreign market as an outlet for tonnages in excess of domestic consumers needs.

MINERAL FUELS

Oil and gas consumption increased substantially to reach record levels while coal showed a modest increase resulting from higher demand for electric power generation and coke oven use. Gas sales gained nearly 12 percent (in fiscal 1967–68) as compared with 7.7 percent the previous fiscal year. The inland consumption of oil in 1968 increased 6 percent, a decline from the 1967 figure of 7.7 percent. Demand for all of the mineral fuels was adversely affected by the Government's policy of economic restraint.

Natural gas developments continued to occupy the spotlight with the completion of long-term purchasing agreements by the Gas Council with the companies that found gas in commercial quantities in the North Sea Continental Shelf and the acceleration of deliveries from two North Sea fields. The Gas Council planned to receive and distribute 2,000 million cubic feet daily of natural gas from the North Sea by 1971–72 and 4,000 million cubic feet a day by the mid-1970's. Work is continuing on a 2,500-mile national transmission and storage system and the rate of conversion of gas appliances in over 12 million residences, 500,000 commercial establishments, and 80,000 industrial premises was accelerated. At yearend nearly 300,000 conversions had been effected and plans called for the changeover of 61 percent of all units by March 31, 1973. Estimates of recoverable natural gas reserves in the four proven North Sea fields were 23 to 25 trillion cubic feet.

Considerable progress was evident in oil refining with the commissioning of three new refineries with a total capacity of 12.5 million tons per year, bringing Britain's total refinery capacity to 97.4 million tons at yearend. Four additional refineries were in the planning or construction stage with a combined projected capacity of 12 million tons per year and planned additions to existing refineries to be completed in 1969–70 totaled almost 10 million tons per year. The consumption of oil, which has grown at slower rates since 1966, has been shifting toward the lighter fractions and

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away from the fuel oils, the consumption of which was stationary in 1968. The 245-mile Thames-Mersey oil product pipeline came into full operation in November. It was Britain's first coast to coast commercial pipeline. Though exploration both onshore and offshore continued during the year no oil deposits of significance were found to add to Britain's very modest oil reserves which supported a production of 1,700 barrels per day in 1968.

The rise in coal consumption, which interrupted a long series of annual declines, was chiefly due to a government program to provide for the use of about 6 million tons of subsidized coal in power stations and gas works up to 1970. The continued decline of coal production accords with government estimates of the declining role of coal in the United Kingdom fuel economy. However, the National Coal Board (NCB) expects to improve the competitiveness of coal so that sales in 1975 will exceed the 120-million-ton annual total estimated by the Government. The NCB plans to accomplish this through cost reductions resulting from the closure of uneconomic colleries, continued progress in the use of improved equipment and machinery and new mining and management techniques, and selecting more consistently profitable areas for mining.

Coal.—Production declined 4.8 percent in line with the continuing trend toward contraction of the coal industry. However, inland consumption showed an increase of about 3 percent brought about by a 6 million ton gain in thermal-electric power consumption and a 1.4-million-ton increase in coke over use which more than compensated for losses in gas-plant, domestic use, and other consumption. Coke oven consumption of coal rose from 23.4 million tons in 1967 to 24.9 million tons in 1968, while the use of coal in the manufacture of town gas declined by 4 million tons, reflecting increased gas output from oil-based plants and the rising use of natural gas.

Mine employment fell by 57,200 during the year as the result of accelerated mine closures. Total employment at yearend was 324,000. During the year 70 colleries, employing 36,000 workers, were closed, including 16 whose closure had been postponed at the Government's request in 1967, and six which were merged with others. In 1967 there were 29 closures and 61 in 1966. At the close of 1968, 330 colleries remained in operation. There were 111 fatalities during the year as compared with 140 in 1967. The rate of fatalities per 100,000 man-shifts was the lowest recorded (0.14 compared with 0.17 in 1967). No major mine disasters occurred during the year.

The average output per man-shift increased 9 percent, nearly twice as much as in the previous year, and the highest annual increase ever recorded. The average daily output for a coal face rose by about 24 percent, from 477 tons in November 1967 to 590 tons in November 1968, reflecting the closure of uneconomic colleries and the increasing mechanization of the mines together with a substantial drop in the tonnage lost due to industrial disputes.

Coal sales, including exports, totaled 169.8 million tons, 1.4 million more than in 1967. Aided by sterling devaluation, exports increased from 1.9 million tons to 2.7 million tons, while total inland sales were up about 500,000 tons. In the year ended March 31, 1968 thermal power stations accounted for 41.8 percent of inland consumption, coke ovens 13.9 percent, domestic consumers 12.5 percent, industrial consumers 12.1 percent, gasworks 8.2 percent, and miscellaneous 7.7 percent.

Natural Gas.—Total gas sales of 4,222 million therms (1 therm equals 100,000 British thermal units), in the 1967–68 fiscal year ended March 31 rose 11.9 percent from the previous year's level to the highest level ever recorded. When the temperature difference (−0.2° C) compard with 1966–67 is taken into account, the demand was estimated to have grown by 10 percent. The proportion of gas sold in each of the principal market sectors was 62.9 percent to domestic consumers, 21.6 percent to industrial plants, and 13.9 percent to commercial users. Gas manufactured from oil and coal accounted for more than one half of available supplies in 1967–68. The proportion of coal gas continued to decline while gas produced by oil reforming processes again increased its share of the total. Over 1,500 million cubic feet per day of new oil reforming capacity was commissioned during the year. Although the Gas Council intends further to expand new gas manufacturing plants in 1968–69, little additional investment in

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it will be made thereafter, except for small sums on adaptations on some existing reformers to enable them to reform natural gas to town gas pending the conversion of consumer appliances to natural gas. Liquefied natural gas imported from Algeria contributed nearly 9 percent of the gas supply. Natural gas from fields in the North Sea Continental Shelf (the first supplies of which reached the United Kingdom in March 1967) doubled its contribution, accounting for nearly 14 percent of total gas supplies in 1967–68.

During 1968 the Gas Council continued the construction of a national transmission and storage system and to take other steps to make large volumes of natural gas from the North Sea Continental Shelf available to the British consumer. The Gas Council planned to receive and distribute 2,000 million cubic feet of gas per day by 1971–72 and 4,000 million cubic feet per day by the mid-1970's.

The Gas Council completed long-term purchasing arrangements in 1968 with the principal companies that had found gas in definitely commercial quantities in the Continental Shelf. The supplies will come from the Hewett field (shared by the Phillips and Arpet groups), the Leman Bank and Indefatigable fields (shared by Shell/Esso and Gas Council/Amoco groups). The Arpet groups and Mobil Oil also have small shares in the Leman Bank Field. Regular deliveries have been received since March 1967 from British Petroleum's West Sole field and, for the last quarter of 1968, from the Leman Bank field, stated to be the world's largest offshore gasfield. British Petroleum delivered 46,217 million-cubic-feet from the West Sole field in 1968.

Work on the development of the four proven gas fields continued during 1968 and a second 30-inch pipeline was being laid from the Gas Council/Amoco sector of the Leman Bank field 40 miles to the mainland. A new 20-mile, 30-inch pipeline to be completed in October 1969 to connect the Hewett field with the Bacton shore terminal was also under construction at yearend. The initial phase of the giant Bacton terminal was completed in August 1968 and the first natural gas from the Leman Bank field flowed through the terminal on August 13. Upon the completion of the second phase in 1969, the Bacton terminal will be prepared to handle 4,000 million cubic feet of gas per day.

Drilling and exploratory work on the Continental Shelf continued at a slower pace in 1968 and no new fields were proved during the year, although discoveries made by the Gulf Oil Corp. and the Continental Oil/National Coal Board group may later prove to be commercial. During 1968 the number of wells drilled in the North Sea Continental Shelf reached 200 since the spudding of the first offshore well in December 1964.

Work on the construction of the pipeline transmission system to transmit natural gas to all Area Boards continued throughout the year. The construction program provides that about 2,500 miles of trunkline will be built by March 1973, operating at pressures of up to 1,000 pounds per square inch. Construction during the 1967–68 year totaled 250 miles. Pipelines under construction at the close of 1968 and scheduled for completion in 1969 were the 110-mile, 36-inch line from the Bacton terminal to Whitewell Hertfordshire; a 90-mile, 30-inch line from Leeds to Newcastle; a 92-mile, 24-inch line from Churchover to Bath via Wormington, Gloucestershire; a 35-mile, 36-inch line from Churchover to Alrewas; a 28-mile, 36-inch line from Audley, Staffordshire, to Warburton, Cheshire; and a 23-mile, 24-inch line from Audley to Shocklach, Cheshire.

Work began in 1968 on a national control center for the entire transmission system to be established at Hinckley, Leicestershire. The £650,000 ($1.56 million) center is scheduled to come into operation by mid-1969.

The onshore search for natural gas has been encouraged by the results of offshore exploration. Seismic surveys were made in Yorkshire and Lincolnshire by British Petroleum in partnership with the Gas Council and a test well was spudded at yearend in Yorkshire. Drilling was continued by Home Oil of Canada, Ltd. at Lockton and a gas producer was drilled there with an open flow potential of 120 million cubic feet per day. Further development and exploration drilling in the Lockton area is programed for 1969.

During the year additional districts were converted to the direct use of natural gas. Consumers using natural gas directly numbered about 50,000 at the end of March 1968, but Gas Council plans called for the

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main conversion program to begin in the 1968–69 year when it is estimated that the appliances of 5 percent of all domestic consumers (about 600,000) will be converted. It is planned to increase this percentage to 61 in the 1972–73 year. At yearend 1968 nearly 300,000 homes and many industrial premises had been switched to natural gas. The Gas Council forecasts the continuance of the rapid growth of the domestic market, but expects that sales to industry will account for an increasing proportion of total sales. The growth of sales to industry will be achieved by developing premium markets and by negotiating bulk sales agreements.

Gas Council estimates of recoverable natural gas reserves in the North Sea amount to some 23 to 25 trillion cubic feet, sufficient to maintain an average daily flow rate of between 2,000 and 3,500 million cubic feet for 20 to 30 years. These estimates refer only to the four proved gas fields and do not include estimates for discoveries not yet proved.

Petroleum.—Inland consumption of oil products attained a record high in 1968, an increase of 6 percent over 1967 consumption. The rate of increase declined from 8 percent in 1966 and 7.7 percent in 1967 due chiefly to the Government's continued policy of economic restraint. Consumption of fuel oils, which accounted for 37 percent of the total, remained stationary, while demand for the lighter fractions and middle distillates, notably naphtha, gas/diesel oil, aviation turbine fuel and kerosine continued to increase sharply. Motor gasoline consumption rose by 6 percent, though there were two increases in gasoline taxes totaling 8.7 pence (8.7 U.S. cents) during the year which brought total taxes per imperial gallon to 4 shillings 3.7 pence (51.7 U.S. cents).

The annual capacity of the United Kingdom's 22 oil refineries was about 97.4 million tons at yearend as compared with 84 million tons at the close of 1967. Three new refineries came on stream during the year; Shell's Teesport refinery near Middlesbrough with a capacity of 6 million tons yearly; the Lindsay refinery at Killingholme, Lincolnshire, owned jointly by Total Great Britain and Petrofina (G.B.) Ltd., with a (first-stage) capacity of 3.5 million tons; and the Gulf Oil Corporation's Milford Haven refinery having a capacity of 3 million tons. At yearend four new refineries with projected capacity of 12 million tons were in the planning or construction stages, while additions to existing refinery capacity to be made in 1969–70 totaled 9.6 million tons. Details are as follows:

Company	Location	Capacity (metric tons per year)	Probable completion date
Under construction or planned:			
Continental Oil (U.K.) Ltd.	Immingham	4,500,000	Late 1969.
Isle of Man Petroleums, Ltd. (Natomas).	Point of Ayre, Isle of Man	500,000	1972.
Murco Petroleum Ltd.	Longhaugh Point, Clydeside	2,000,000	1971.
Planet Oil and Mineral Corp. (Grampian Chemicals).	Invergordon	5,000,000	Mid-1972.
Additions to existing capacity:			
British Petroleum Ltd.	Grangemouth	2,000,000	Early 1970.
Burmah Oil Co. Ltd.	Ellesmere Port	850,000	Mid-1970.
Lindsay Oil Refining Ltd. (Total/Petrofina).	Killingholme	3,500,000	Late 1969.
Mobil Oil, Ltd.	Coryton	3,250,000	Late 1969.

The 245-mile Thames-Mersey pipeline system came into operation along its full length with the inauguration of the Kingsbury (Birmingham) terminal in November 1968. The line is the first coast-to-coast commercial pipeline in the United Kingdom. It was constructed to supply white products to London and Midland markets, and consists of two separate lines—one dispatching products northward from refineries on the Thames Estuary to terminals at Buncefield, Northampton, and Kingsbury, and another running southwards from the Mersey to Uttoxeter and Kingsbury. Initial annual throughput will be nearly 4 million tons and it will be possible to increase the capacity to 8 million tons. Built at a cost of £8.5 million ($20.4

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million) the pipeline is run by U.K. Oil Pipelines, Ltd., a joint enterprise of Shell-Mex British Petroleum (59.3 percent); Texaco/Regent (22.3 percent); Mobil Oil (13.4 percent); and Petrofina (5 percent).

A 250-mile products pipeline with a diameter of about 18 inches from Milford Haven (Wales) to the Midlands continued in the planning stage at yearend. Its sponsors, Esso, Texaco, and Gulf, who have refineries near Milford Haven, applied for government authorization covering 180 miles of the projected 250 miles.

Esso obtained Government authorization to lay a 64-mile, 10-inch insulated fuel oil pipe from Fawley to West London.

British Petroleum Ltd.'s new 58-mile, 20-inch crude oil pipeline from Finnart to its Grangemouth refinery, replacing an old 12-inch line, was commissioned in late 1968.

Crude oil production showed a slight decline as compared with that in 1967, but the low level of output (1,700 barrels per day), made no significant contribution to the country's oil requirements. Drilling in the North Sea Continental Shelf had not yielded oil in commercial quantities by yearend. Onshore drilling in 1968 produced no significant additions to production capacity.

The Continental Oil Co. in partnership with Envoy Oil Ltd. and Marathon Petroleum G.B. Ltd., planned to drill an exploratory well in East Anglia between Horsey and Somerton under a production license granted by the Minister of Power to the group for 235,734 acres in the area.

British Petroleum, Ltd., announced in November an agreement with the Atlantic Richfield Company and the Sinclair Oil Corporation to acquire the latter Company's marketing outlets in 11 States from Maine to Maryland and the District of Columbia for $400 million. The agreement also included Sinclair's Marcus Hook and Port Arthur refineries and their pipeline facilities to the Eastern States. When finalized, the acquisition will give British Petroleum access to the U.S. retail market for the first time.

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The Mineral Industry of Venezuela

By Gordon W. Koelling[1]

Venezuela's index of mineral industry production rose less than 1 percent during 1968. The mineral industry however, contributed approximately 28 percent to the country's gross national product (GNP) of US$9,110 million [2] and also provided between 65 and 70 percent of Government revenue and over 95 percent of foreign exchange earnings.

The petroleum (including natural gas) industry accounted for about 94 percent of the mineral industry's 1968 contribution to GNP. Venezuela remained the world's leading petroleum exporting country and retained third place among the world's crude oil producing nations behind the United States and the U.S.S.R.

Venezuela's crude oil output increased 2 percent during 1968 primarily as a result of the continuing Middle East crisis and its effect on tanker rates and world oil supply patterns. Other favorable factors included the wide variety of crude oils produced in Venezuela and the country's stable political situation. However, reserves of crude oil and natural gas continued to decline, and production costs remained high in comparison with those in other major petroleum exporting countries. Antipollution regulations severely limiting the allowable sulfur content of fuels used in the Eastern United States continued to restrict the export of Venezuelan residual fuel oil to its principal market. Desulfurization facilities with a combined throughput capacity of 235,000 barrels per day were placed under construction during the year at the country's two largest refineries in an attempt to at least partially alleviate this problem.

Most of the value of Venezuela's nonpetroleum minerals output in 1968 was accounted for by iron ore.

During the year the Mining Promotion Committee was formed for the purpose of interesting private investors in the development of medium-sized mining operations, especially those associated with gold, magnesite, asbestos, and phosphates. This committee was made up of representatives of the Ministerio de Minas e Hidrocarburos and the Corporación Venezolana de Fomento.

[1] Geographer, Division of International Activities.
[2] Where necessary, values have been converted from bolivares (Bs) to U.S. dollars at the rate of Bs4.50 = US$1.

Table 1.—Venezuela: Salient statistics

	1964	1965	1966	1967	1968 p
Gross national product (GNP)—million US$	7,215	7,575	7,935	8,515	9,110
Mineral industry contribution to GNP—do	NA	NA	NA	NA	2,550
Index of industrial production—(1963 =100)	110	115	115	129	[1] 126
Index of mineral industry production [2]—do	108	111	108	112	[3] 113
Value total exports—million US$	2,054	2,895	2,861	3,383	NA
Value mineral commodity exports—do	2,012	2,852	2,809	3,006	NA
Value total imports—do	1,102	1,267	1,165	1,286	NA
Value mineral commodity imports—do	107	126	103	120	NA

p Preliminary. NA Not available.
[1] 8 months.
[2] Crude minerals only.
[3] 6 months.

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PRODUCTION

Performance of the various sectors of Venezuela's mineral industry was mixed during 1968, and the index of mineral production rose only slightly. Production of such major items as crude oil, natural gas, diamonds, fertilizer materials, and salt increased, as did the output of some of the country's other mineral commodities. However, the production of iron ore, coal, and natural gas liquids declined significantly.

Table 2.—Venezuela: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Aluminum, metal	--	--	--	3,090	10,000
Gold, metal, troy ounces	33,536	23,660	[r] 16,900	20,000	20,600
Iron and steel:					
Iron ore and concentrate, thousand tons	15,656	17,510	17,759	17,005	16,190
Pig iron, do	323	334	351	422	614
Steel ingots and castings, do	[r] 360	[r] 537	[r] 420	564	747
Steel semimanufactures, do	[r] 290	[r] 430	[r] 370	500	636
NONMETALS					
Cement, hydraulic, do	1,850	2,112	2,114	2,248	2,438
Diamond:					
Gem, carats	57,467	52,313	41,796	38,218	59,655
Industrial, do	58,137	38,644	42,903	31,409	54,345
Total, do	115,604	90,957	84,699	69,627	114,000
Fertilizer materials:					
Crude (natural): Phosphate rock [e]	--	6,000	16,000	30,000	60,000
Manufactured: Nitrogenous, gross weight [2]	132,847	94,754	114,908	135,245	151,526
Gypsum [e]	74,800	85,900	86,900	91,000	99,000
Lime	67,609	64,281	44,436	NA	NA
Salt, all types	203,000	172,000	149,000	[e] 85,000	126,000
Stone; limestone [e], thousand tons	2,462	2,655	2,750	2,890	3,170
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	6,128	6,804	7,350	7,350	7,350
Coal, bituminous	36,250	29,939	34,215	34,458	30,825
Gas, natural:					
Gross production, million cubic feet	1,386,800	1,442,456	1,457,570	1,616,014	1,634,623
Marketed, do	237,419	249,815	263,894	292,655	301,200
Natural gas liquids:					
Condensate, thousand 42-gallon barrels	1,754	1,909	1,540	1,896	1,987
Natural gasoline, do	2,935	3,186	3,143	3,334	3,183
Liquefied petroleum gases, do	5,823	6,004	6,637	7,462	7,397
Total, do	10,512	11,099	11,320	12,692	12,567
Petroleum:					
Crude oil, do	1,241,782	1,267,602	1,230,464	1,292,876	1,319,340
Refinery products: [3]					
Gasoline and naphthas, do	45,014	47,428	50,662	50,244	57,326
Kerosine, do	9,880	7,961	6,069	5,042	4,740
Jet fuel, do	13,678	15,805	20,451	26,183	24,791
Distillate fuel oil, do	77,708	71,071	70,799	67,642	67,006
Residual fuel oil, do	233,951	268,080	260,617	255,991	258,839
Lubricants, do	4,638	3,721	3,746	3,788	4,199
Asphalt and bitumen, refinery, do	5,443	5,171	4,948	5,477	5,476
Refinery gas [4], do	4,522	6,006	6,642	5,692	5,564
Other, do	5,786	3,528	4,946	4,872	5,496
Total, do	400,620	428,771	428,880	424,931	433,437

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to reported commodities, Venezuela is known to produce sand, gravel, and clay, but data are not available on the output of these items.

[2] Sales.

[3] Includes refinery fuel.

[4] Liquid equivalent.

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TRADE

Exports of mineral commodities dominated Venezuela's foreign trade during 1966 and 1967, the latest years for which complete trade information is available. Petroleum accounted for more than 95 percent of all minerals exported during these years. The United States was the principal destination of direct petroleum shipments, followed by the Netherlands Antilles. However, almost all of the petroleum exports to the latter area consisted of crude and unfinished oils destined for processing at two large refineries owned by the parent companies of Creole Petroleum Corp. and Cía. Shell de Venezuela, Ltd., Venezuela's first- and second-ranking crude oil producers. These refineries export their output and are, in a sense, an integral part of Venezuela's petroleum industry.

Exports of Venezuelan petroleum from Venezuela and the Netherlands Antilles by principal areas of destination for 1966–68 were as follows:

Destination	Exports (thousand 42-gallon barrels)		
	1966	1967	1968
Western Hemisphere:			
Canada	105,362	142,541	155,357
Puerto Rico	55,202	56,279	63,618
Trinidad and Tobago	55,022	67,045	76,666
United States	512,485	507,032	505,091
Other	137,074	131,507	150,976
Total	865,145	904,404	951,708
Eastern Hemisphere:			
Western Europe:			
European Economic Community	76,371	98,749	77,196
Spain	20,453	29,370	28,004
United Kingdom	84,454	80,003	81,243
Other	45,888	39,435	31,540
Subtotal	227,166	247,557	217,983
Other	42,221	46,612	43,823
Total	269,387	294,169	261,806
Grand total	1,134,532	1,198,573	1,213,514

Source: Republic of Venezuela. Ministry of Mines and Hydrocarbons. Monthly Bulletin, April 1969.

High tanker rates resulting from the Suez Canal shutdown were partially responsible for the 5-percent rise in exports to the Western Hemisphere during 1968. The slight decline in total petroleum exports to the United States occurred despite an increase in crude oil shipments. Venezuelan petroleum exports lost ground in most major markets of the Eastern Hemisphere except the United Kingdom.

Table 3.—Venezuela: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	840	301	United States 266; United Kingdom 31.
Copper, metal, including alloys, all forms	726	1,681	Mainly to Spain.
Gold, metal, unworked or partly worked. troy ounces	-------	19,290	All to West Germany.
Iron and steel:			
Ore and concentrate thousand tons	17,037	16,467	Mainly to United States.
Metal:			
Pig iron, ferroalloys and similar materials.	10	79,971	Japan 62,027; United States 17,794.
Steel, primary forms	33,802	162,600	Argentina 69,244; Mexico 62,845; Italy 20,499.

See footnotes at end of table.

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Table 3.—Venezuela: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Iron and steel—Cont.			
Semimanufactures:			
Bars, rods, angles, shapes, sections.	-------	22	Mainly to Trinidad and Tobago.
Sheets and plates	568	49	Mainly to Netherlands Antilles.
Tubes, pipes and fittings	12,896	37,899	Colombia 27,962; United States 6,701.
Zinc, metal, including alloys	1	(1)	All to Colombia.
Other, ore and concentrate of nonferrous base metals.	-------	2	All to Spain.
NONMETALS			
Cement	163,094	146,371	Surinam 45,325; Martinique 26,949.
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s.: Kaolin (china clay)	1	25	All to Italy.
Products: Refractory (including nonclay brick).	8	18	All to Colombia.
Fertilizer materials, crude:			
Nitrogenous	4,967	-------	
Potassic	5	-------	
Gypsum and plasters	2,201	6,800	All to Netherlands Antilles.
Lime	8	10	Do.
Magnesite	1,001	-------	
Salt	-------	59,024	Japan 48,224; United States 10,800.
Sodium compounds	-------	25	All to Netherlands Antilles.
Stone, sand and gravel:			
Dimension stone, crude and partly worked.	535	495	Mainly to Netherlands Antilles.
Sand and gravel	21	82	All to Colombia.
Other nonmetals, n.e.s.	509	4	Netherlands Antilles 2; Jamaica 1.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black	11,852	21	All to Colombia.
Coal and coke, including briquets	70	139	Do.
Gas hydrocarbons, natural gas liquids:			
Natural gasoline. thousand 42-gallon barrels	2,563	2,756	Netherlands Antilles 1,375; United States 761.
Liquefied petroleum gasses ------do----	r 4,851	5,741	Argentina 2,362; Brazil 2,114.
Petroleum:			
Crude and partly refined ------do----	826,072	886,635	Netherlands Antilles 278,294; United States 157,193; Canada 90,696.
Refinery products:			
Gasoline ------do----	23,710	22,639	United States 5,435; Dominican Republic 5,163; United Kingdom 4,170.
Kerosine ------do----	550	692	Puerto Rico 313; United Kingdom 249.
Distillate fuel oil ------do----	44,947	44,937	Canada 9,602; United States 8,314.
Residual fuel oil ------do----	238,687	239,294	Mainly to United States.
Lubricants ------do----	3,148	2,685	United Kingdom 1,339; Sweden 329.
Asphalt ------do----	3,141	3,210	Mainly to United States.
Other ------do----	21,060	26,801	United States 16,594; Brazil 880.

r Revised.
1 Less than ½ unit.

Source: Direccion General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletin de Comercio Exterior, 1966 and 1967, Venezuela. Memoria y Cuenta, Año 1966 y 1967. Caracas, Venezuela, March 1967 and 1968.

Table 4.—Venezuela: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum, metal, including alloys:			
Unwrought	1,755	2,694	United States 1,956; Canada 501.
Semimanufactures	6,355	10,065	United Kingdom 3,436; United States 2,015.
Antimony, metal, including alloys, all forms	38	18	Belgium-Luxembourg 5; West Germany 5.
Chromite	2,334	2,223	United States 1,447; Philippines 646.
Copper, metal, including alloys:			
Unwrought	63	235	Mainly from United States.
Semimanufactures	7,891	7,083	Chile 3,116; United States 1,358; Canada 981.

See footnotes at end of table.

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Table 4.—Venezuela: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Gold—troy ounces	1,064	4,919	West Germany 3,601; United States 965.
Iron and steel:			
Ore and concentrate	3	57	Mainly from Canada.
Metal:			
Scrap	23,776	4,710	Mainly from United States.
Pig iron, ferroalloys, and similar materials.	6,108	3,646	France 2,010; Italy 565; Norway 520.
Steel, primary forms, ingots	3,068	5,366	West Germany 1,773; United States 1,225; France 813.
Semimanufactures:			
Bars, rods and structural sections.	41,009	55,309	Belgium-Luxembourg 23,096; West Germany 15,995.
Universals, plates and sheets:			
Medium plates and sheets, uncoated.	146,610	223,345	Japan 96,739; Belgium-Luxembourg 29,394; West Germany 28,933.
Other coated plates and sheets.	51,150	69,197	Japan 24,023; France 23,223; Canada 14,516.
Other	14,025	17,684	United States 5,985; Japan 5,058; Canada 3,737.
Hoop and strip	3,718	3,081	Belgium-Luxembourg 767; West Germany 679; United States 647.
Rails and accessories	4,665	1,422	Mainly from United States.
Wire	36,677	24,476	Belgium-Luxembourg 7,974; Japan 5,758; West Germany 4,347.
Tubes, pipes and fittings	74,495	56,960	United States 21,175; West Germany 13,754; France 8,243.
Other	1,283	811	United States 549; West Germany 161.
Lead, metal, including alloys:			
Unwrought	4,422	4,975	Mexico 2,274; United States 873.
Semimanufactures	722	280	Belgium-Luxembourg 61; United Kingdom 58; Australia 29.
Mercury—76-pound flasks	151	55	United States 17; West Germany 14; Italy 9.
Nickel, metal, including alloys, all forms	91	68	United Kingdom 31; United States 27.
Platinum-group metals, including alloys, all forms: Platinum.—troy ounces	3,054	86,839	Mainly from West Germany.
Silver, metal, including alloys:			
Unwrought—troy ounces	59,832	76,961	West Germany 42,503; United States 18,326.
Semimanufactures—do	78,544	84,878	West Germany 39,642; United States 38,259.
Tin, metal, including alloys:			
Unwrought—long tons	225	314	United Kingdom 139; Canada 76.
Semimanufactures—do	12	14	United States 6; United Kingdom 5.
Zinc, metal, including alloys:			
Unwrought	5,342	5,129	Canada 1,938; Mexico 1,100; United Kingdom 858.
Semimanufactures	836	247	United States 188; Colombia 43.
Other:			
Ore, concentrate, and scrap	1,894	20,639	Mainly from United States.
Metals, including alloys, all forms, n.e.s.	238	1,802	Mainly from Norway.
NONMETALS			
Abrasives, natural, n.e.s	201	199	West Germany 146; Italy 36.
Asbestos	5,317	5,011	Mainly from Canada.
Barite	12,201	8,169	Canada 5,789; Morocco 2,373.
Boron materials, borates	1,109	1,461	United Kingdom 367; West Germany 335; Belgium-Luxembourg 279.
Cement	313	515	West Germany 200; France 182; United States 123.
Clays and clay products (including all refractory brick): Crude clay, n.e.s.:			
Bentonite	3,517	4,406	Mainly from United States.
Kaolin (china clay)	5,655	6,478	Do.
Other	11,069	11,035	United States 7,177; Guyana 2,500.
Cryolite and chiolite	7	1,104	West Germany 817; Italy 283.
Diamond, industrial—thousand carats	1,995	20	All from United States.
Diatomite and other infusorial earths	2,928	2,931	Mainly from United States.
Feldspar	8,533	8,319	United States 6,204; Canada 2,008.
Fertilizer materials, crude:			
Nitrogenous	10,003	27,954	United States 17,954; West Germany 10,000.
Phosphatic	5,329	10,752	Mainly from United States.
Potassic	15,842	25,300	France 10,000; Italy 9,800; United States 5,500.
Mixed	62	365	United States 192; West Germany 161.

See footnotes at end of table.

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Table 4.—Venezuela: Imports of mineral commodities—Continued

(Metric ton unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Fluorspar	3,804	1,999	Mainly from Mexico.
Graphite, natural	533	270	Mainly from United States.
Gypsum and plasters	126	210	United Kingdom 138; United States 59.
Lime	11	16	Mainly from United States.
Magnesite	2,914	1,800	United States 1,402; Netherlands 277.
Mica, all forms	392	488	Mainly from United States.
Salt	406	(1)	Mainly from Italy.
Sodium compounds	28,751	48,331	Mainly from United States.
Stone, sand and gravel:			
Dimension stone	2,835	3,462	Italy 2,289; Norway 560.
Crushed rock	24,514	49,608	Mainly from United States.
Sand and gravel	2,875	5,045	United States 3,142; Belgium-Luxembourg 1,712.
Sulfur [2]	3,506	26,891	United States 14,051; Poland 10,165.
Talc, steatite	2,983	3,437	United States 1,711; Italy 870; Norway 468.
Vermiculite	453	221	United States 144; Republic of South Africa 77.
Other nonmetals, n.e.s.	409	1,544	Mainly from United States.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	87	245	Do.
Carbon black	745	460	United States 346; Canada 85.
Coal, all grades, including briquets	3,903	4,463	Mainly from United States.
Coke and semicoke	156,327	208,881	West Germany 86,060; United States 75,240.
Petroleum refinery products:			
Gasoline---thousand 42-gallon barrels	40	209	Mainly from Netherlands Antilles.
Kerosine---do	1	1	Mainly from Netherlands.
Lubricants---do	28	37	Mainly from United States.
Mineral jelly and wax---do	21	2	Do.
Other bitumen mixtures---do	72	57	Do.

[1] Less than ½ unit.
[2] Mostly unrefined.

Source: Dirección General de Estadística y Censos Nacionales, Ministerio de Fomento, Boletin de Comercio Exterior, 1966 and 1967, Venezuela.

COMMODITY REVIEW

METALS

Aluminum.—In May 1968, the Ministerio de Minas e Hidrocarburos and Minera Montecristo, C.A., a privately owned Venezuelan firm, signed a contract providing for the geologic exploration, extraction, and sale of laterites with a high aluminum content occurring in a 2,000-hectare area in the State of Bolívar. This contract stipulated that the contractor must submit a detailed report, within 24 months, on the feasibility of extracting the bauxitic laterites found in the agreement area for use by the refractory industry. It also provided that, should exploitation prove feasible, the company will extract a gross volume of not less than 2,000 tons nor more than 6,000 tons of laterite per year. The contractor may only sell the mineral to national enterprises that produce refractory materials and other industrial or trade products.

Gold.—Core drilling operations to evaluate the gold reserves in the State of Bolívar were in progress during 1968. A technical and financial aid program was also being implemented to aid small mines in the El Callao and El Dorado areas of the same State. The Government signed a contract with the Mowac Co. of Canada for the exploitation of the principal gold deposits at El Callao. These deposits were once worked on a large scale but operations gradually declined after World War II as the result of rising costs, and all significant activity was halted in the early 1950's.

Iron and Steel.—The production of iron ore declined almost 5 percent during 1968 as a result of increased competition in West European export markets from new sources of ore in Africa which had lower production costs and a transportation advantage. Almost all of Venezuela's output was accounted for by the Orinoco Mining Co., a subsidiary of United States Steel Corp., which produced 12.9 million tons and Iron Mines Co. of Venezuela, a sub-

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sidiary of Bethlehem Steel Corp., which produced 2.9 million tons. Most of the country's iron ore production was exported, and all domestic consumption was accounted for by Siderúrgica del Orinoco, S.A. (SIDOR), a subsidiary of the Government-owned Corporación Venezolana de Guayana (C.V.G.).

Orinoco Mining initiated construction during 1968 on a 1-million-ton-per-year iron-ore briquetting plant at Puerto Ordaz. This plant will use a natural gas reduction process to upgrade ore to an average 86.5-percent iron content. The Export Import Bank was financing 60 percent of the cost of this plant which was estimated to exceed $50 million.

In July 1968, the Ministerio de Minas e Hidrocarburos signed a contract with a group of companies for a study to determine the feasibility of exploiting the San Isidro iron-ore deposits in the Sierra Imataca. Companies comprising the contract group were Wells Overseas, Ltd., of Canada, Ensid and Compagnie Industrielle des Travaux of France, and Phillip Brothers of the United States. The contract stipulated that the study consider a target production rate of 4.5 million tons of iron ore per year. According to an evaluation made by the Ministerio, the San Isidro deposits contain reserves totaling 350 million tons of ore with an average iron content of 64 percent.

Venezuela's output of pig iron, which was produced exclusively by SIDOR, increased 45 percent during 1968. The output of crude steel (ingots and castings) and semimanufactures, which rose 32 and 27 percent, respectively, was also accounted for primarily by SIDOR with small quantities being produced by Siderúrgica Venezolana, S.A. (SIVENSA), a private company.

Contracts were awarded during the year for the purchase of several new units for SIDOR's Ciudad Guayana steel mill. Among these units were an $800,000 scarfing machine bought from Union Carbide Co. and two soaking pits, with a daily capacity of 125 tons each, purchased from the Rust Furnace Co., a division of Litton Industries. An award for a $2.5 million oxygen unit went to the Air Reduction Co., Inc. (Airco), of New York.

In late 1968 SIDOR issued an invitation for bids on the supply, installation, and preliminary operation of the equipment for its planned expansion into flat products manufacture. The interested firms or groups ruled qualified to bid were a Japanese consortium, Davy and United Engineering Co., Ltd., of the United Kingdom, a Belgium/German consortium, and a U.S. consortium consisting of United Engineering and Foundry Co. and Wean Industries, Inc. A deadline of June 1969 was set for these bids.

Nickel.—A study of the feasibility of developing the nickel deposits at Loma de Hierro in the State of Aragua was completed during the first half of 1968. This survey, performed by Société Le Nickel, a French company, confirmed the presence of reserves totaling 40 million tons of ore with a nickel content averaging 1.58 percent. It also indicated promising prospects for commercial exploitation of these deposits.

Other Metals.—Early in 1968 the Ministerio de Minas e Hidrocarburos announced the discovery of extensive deposits of several metallic minerals in various parts of the country. Tin was found near Monte Carmelo, Caucagua, Timotes, Barquisimeto, Chacon, and Altagracia de Orituco. Indications of tungsten and silver were also found in the same areas. Copper was discovered in the State of Aragua, and manganese deposits were found near Upata.

NONMETALS

Fertilizer Materials.—Work commenced during 1968 on the expansion of chemical fertilizer facilities at Morón. The ammonia output capacity of this plant, owned by Instituto Venezolano de Petroquímica (I.V.P.), the national petrochemical company, was to be expanded from 120,000 tons per year to 200,000 tons annually as a result of this project. Construction of the new ammonia facilities was being carried out by Mitsubishi Heavy Industries, Ltd., of Japan.

Civil works construction was initiated in June 1968 at the site of a planned petrochemicals complex at El Tablazo near Lake Maracaibo. The first petrochemical facility to be erected there will be the ammonia plant of Venezolana de Nitrogeno, a joint venture owned 50 percent by I.V.P., 30 percent by International Development and Investment, a U.S. and European con-

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sortium, and 20 percent by Petroquímica Atlántico of Colombia. This plant will have a capacity to produce 1,800 tons of ammonia and 1,400 tons of urea daily.

During May 1968, the Government signed an agreement for the construction of an ammonia plant at Bajo Grande with Venezuelan Sun Oil Co., I.V.P., Venezuelan Atlantic Refining Co., Texaco Maracaibo, Inc., and Texaco Seaboard, Inc. All of these companies hold a 23.6-percent interest in the project except Texaco Seaboard, Inc., which has an interest of only 5.6 percent. This plant will have a capacity of 1,500 tons of ammonia per day and will cost approximately $45 million.

Magnesite.—The Venezuelan Development Corp. (C.V.F.) awarded a $90,000 contract to Prospection, Ltd., of Canada, to examine the feasibility of mining the Loma de Guerra magnesite deposits on Margarita Island off Venezuela's northern coast. On the basis of a recent survey, C.V.F. estimated recoverable reserves of 5 million tons of raw magnesium carbonate at Loma de Guerra. At least two U.S. firms, A.P. Green Refractories and J. E. Baker Co., have indicated an interest in participating in the exploitation of these deposits.

MINERAL FUELS

Coal.—The output of coal declined almost 11 percent during 1968. Almost all production was from the State of Táchira where C.A. Minas de Carbón de Lobatera continued to be the principal producing company. No development work was performed at the Naricual coal mines despite a Government commission's recommendation that they be reactivated.

Petroleum and Natural Gas.—Crude oil production rose 2 percent to 3,604,754 barrels per day in 1968. Most of this increase was accounted for by the growing output of medium crudes (22.1° to 30° API) although small gains were also registered by the production of light crudes (over 30° API). The output of heavy crudes (under 22.1° API) declined slightly. Companies owned by U.S. firms produced almost 74 percent of the total 1968 output with Creole Petroleum Corp., a subsidiary of Standard Oil Co. (New Jersey), alone accounting for 42 percent.

Natural gas production increased approximately 1 percent to 4,466 million cubic feet per day during 1968. Over 98 percent of the natural gas produced was from oilfields. Output of natural gas liquids declined slightly in conjunction with a decrease in the quantity of natural gas run to natural gas processing plants.

Table 5.—Venezuela: Salient statistics of the petroleum and natural gas industry

		1966	1967	1968
Crude oil:				
Production	thousand 42-gallon barrels	1,230,464	1,292,876	1,319,340
Processed at refineries	do	428,382	425,532	434,032
Exports	do	826,072	886,635	898,499
Natural gas:				
Production	million cubic feet	1,457,570	1,616,014	1,634,623
Sales	do	102,377	119,329	125,332
Producers' fuel	do	139,739	145,886	148,464
Shrinkage due to extraction of natural gas liquids	do	21,789	27,440	27,404
Field intection	do	652,435	700,650	738,189
Flared or otherwise lost	do	541,230	622,709	595,234
Natural gas liquids:				
Production	thousand 42-gallon barrels	11,320	12,692	12,567
Exports	do	7,414	8,497	NA
Refinery products:				
Refinery output [1]	do	428,880	424,931	433,437
Consumption	do	65,574	66,768	70,888
International bunkers	do	19,605	19,801	20,380
Exports	do	335,243	340,258	334,360

NA Not available.
[1] Includes refinery fuel.

Source: Ministerio de Minas e Hidrocarburos, Venezuela. Memoria y Cuenta, Año 1967. Caracas, Venezuela, March 1969.

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Proved reserves of crude oil declined for the third consecutive year, dropping 283 million barrels to a reported total of 15,674 million barrels at yearend 1968. Gas reserves, which also continued to decline, totaled 26,584 billion cubic feet as of the same date, 1,247 billion cubic feet less than at yearend 1967. These decreases were primarily a reflection of the relatively low level of exploratory activity. Geologic and geophysical exploration and exploratory development, and injection drilling activities were as follows:

	1966	1967	1968
Geologic and geophysical exploration:			
Geologic surveying party months	5.8	4.2	3.5
Gravimetric surveying party months	-----	-----	0.5
Magnetic surveying party months	-----	-----	0.5
Seismic surveying party months	8.3	5.6	9.2
Structural drilling party months	5.5	5.1	5.0
Total ---- do ----	19.6	14.9	18.7
Drilling:			
Wells drilled:			
Exploratory:			
Oil--number--	58	r 44	74
Dry----do----	32	r 31	26
Subtotal number--	90	r 75	100
Development:			
Oil----do----	290	232	324
Dry----do----	14	11	14
Subtotal number--	304	243	338
Injection---do----	9	8	9
Total----do----	403	326	447
Footage drilled thousand feet--	r 2,024	r 2,448	3,487

Source: Ministerio de Minas e Hidrocarburos, Venezuela. Memoria y Cuenta, Año 1966, 1967, y 1968. Caracas, Venezuela, March 1967, March 1968, and March 1969.

During the early part of 1968, the Government oil company, Corporación Venezolano del Petróleo (C.V.P.), awarded a contract to Degolyer and McNaughten, a U.S. company, for a geologic study of natural gas possibilities in Eastern Venezuela. The Philadelphia, Pa. public gas service, which has been studying the feasibility of importing liquefied natural gas from Venezuela, agreed to purchase the results of this survey.

During March 1968, C.V.P. announced the minimum conditions for service contract tenders covering approximately 250,000 hectares in the southern part of Lake Maracaibo. These conditions specified that C.V.P. was to receive (1) at least 10 percent of any crude oil found, at cost; (2) the right to dispose of all natural gas produced and not used by the contractor for conservation and oil recovery (this extra gas to be delivered to C.V.P. at no other cost than that already charged to oil production); (3) authority in conjunction with the contractor jointly to set the price at which export oil can be sold; (4) authority to alternate with the contractor in deciding which parcels of an individual block are to be developed once commercial oil is found; (5) the right to obtain financial participation in the operations as additional compensation for its activities; (6) payment equivalent to 5 percent of the royalty for the concept of depletion. The minimum conditions also stipulated that, in analyzing offers, C.V.P. would take into account special advantages offered such as bonuses, a right to obtain an equity stake in any company set up by the contractor under the service contract, participation in operations outside of the country, and other special inducements.

In July 1968, C.V.P. received bids for contracts covering the southern Lake Maracaibo area from 11 companies or groups of companies. Of the total of 17 firms involved, 11 were U.S.-owned. Negotiations with respect to these offers were in progress at yearend.

The capacity of natural gas injection facilities was raised by 314 million cubic feet per day to a total of 3,398 million cubic feet daily in 1968. Gas injection during the year was at an average rate of 2,082 million cubic feet per day. Water injection capacity was increased 192,000 barrels daily to a total of 1,314,000 barrels per day by yearend 1968, and the average daily injection rate during the year was 898,000 barrels.

Venezuela's refineries processed almost 33 percent of the country's crude oil output during 1968 when refinery throughput averaged 1,186,000 barrels per day. Refinery output increased approximately 2 percent to 1,184,000 barrels per day in 1968. This was about 88 percent of rated capacity which was raised only 1 percent during the year. This small increase in capacity was accounted for by a 7,000-barrel-per-day expansion of the Mobil Oil Co. de

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Venezuela refinery at El Palito and a 5,000-barrel-per-day expansion of the Creole Petroleum Corp. plant at Amuay.

Construction was initiated during 1968 on desulfurization projects at the Amuay refinery and at the Cía. Shell de Venezuela, Ltd., refinery at Cardón. Desulfurization facilities under construction at Amuay will be able to process 185,000 barrels of high-sulfur residual fuel oil daily, and those at Cardón will have a throughput capacity of 50,000 barrels per day. Both plants will use a hydrogen process with natural gas from oilfields in the Lake Maracaibo area providing the feedstock for the necessary hydrogen.

In October 1968, C.V.P. and I.V.P. requested offers for the formation of a joint Government-private enterprise for the construction and operation of a 140,000-barrel-per-day refinery. This request specified that: (1) C.V.P. and I.V.P. combined capital holdings in the company were to total at least 51 percent; (2) the contract was to be for 20 years with reversion to the Government of all assets at the end of that time; (3) C.V.P. was to supply the heavy crude oils to be processed; (4) C.V.P. and I.V.P. were to have preferred access to the refinery's output.

A total 381 kilometers of petroleum and natural gas pipelines was placed in service during 1968. Data on the length of pipelines in operation at yearend were as follows:

Type of line	Total length (kilometers)
Crude oil:	
Trunk	3,574
Secondary	2,832
Subtotal	6,406
Refined products	483
Natural gas	2,275
Total	9,164

Source: Ministerio de Minas e Hidrocarburos, Venezuela. Memoria y Cuenta, Año 1968, March 1968.

In May 1968, Venezuelan Atlantic Transmission Corp., a subsidiary of Venezuelan Atlantic Refining Co., agreed to transfer its natural gas pipeline network and other facilities located in the States of Carabobo and Guárico to C.V.P. in 1970, without charge. In return, C.V.P. agreed to deliver 110 million cubic feet of gas per day to Venezuelan Atlantic Transmission Corp., at the best market price available, until the transfer is completed.

C.V.P. awarded a contract for the construction of a 230-kilometer natural gas pipeline from Anaco to Puerto Ordaz in December 1968. This line is to supply gas to Orinoco Mining Co.'s iron-ore processing plant under construction at Puerto Ordaz.

Two important natural gas pipeline projects received government approval during 1968. The longest of these pipelines is to be constructed by Creole Petroleum Corp. to supply natural gas from Ulé in the northeastern Lake Maracaibo area to desulfurization facilities under construction at the Amuay refinery and on the island of Aruba in the Netherlands Antilles. This line will be 238 kilometers in length and have a capacity of 165 million cubic feet per day. The other natural gas pipeline approved for construction is to be built jointly by C.V.P. and Cía. Shell de Venezuela, Ltd., and will connect a gas compression plant in the center of Lake Maracaibo to the El Tablazo petrochemicals complex and the La Paz-Cardón gas transmission line. Length of the new line is to be 106 kilometers, and it will have a maximum capacity of 275 million cubic feet per day.

The expansion of Venezuela's petrochemicals industry continued to be viewed by the Government as an important means of diversifying the country's economy, and construction or planning was in progress on several petrochemical projects in addition to those summarized previously under "Fertilizer Materials."

Construction neared completion at yearend 1968 on dodecyl-benzene and phthalic anhydride plants in Valencia. The dodecyl-benzene plant, which will have an annual capacity of 15,000 tons, was being built by Química Venoco, a company owned 55 percent by private Venezuelan investors and 15 percent each by Phillips Investment Corp., Inversiones Shell, and I.V.P. Oxidaciones Orgánica, owned primarily by Venezuelan private investors, was erecting the phthalic anhydride plant which was to have a capacity of 4,500 tons per year.

Project details for a 50,000-ton-per-year, low-density polyethylene plant planned for the El Tablazo petrochemicals complex were still being negotiated at yearend. This plant is to be built by Unicar Petroquímica,

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C.A., which is owned 60 percent by Union Carbide Corp. and 40 percent by I.V.P.

A project involving the construction of a plant at Morón to produce ammonium sulfate, hydrofluoric acid, and fluorinated hydrocarbons, was canceled due to financing difficulties. The plant was to have been built by Química Carabobo, C.A., a joint enterprise involving Allied Chemical Corp. and I.V.P.

Table 6.—Venezuela: Distribution of landholdings, crude oil production, and refining capacity by companies, 1968

Company	Principal ownership or affiliation	Nationality of ownership	Concessions [1] and assignations [2] as of Dec. 31, 1968 (hectares)	Crude oil production (thousand 42-gallon barrels)	Refining capacity as of Dec. 31, 1968 (thousand 42-gallon barrels daily)
PRIVATE					
Caracas Petroleum, S.A.	Ultramar Co., Ltd.	British	29,883	2,424	---
Chevron Oil Co. de Venezuela, S.A.	Standard Oil Co. of California.	United States	135,157	19,676	62
Cía. Shell de Venezuela, Ltd.	Royal Dutch/Shell Group.	British/Dutch	313,131	337,654	414
Cía Espanola de Petroleos, S.A.	Cía. Española de Petroleos, S.A.	Spanish	10,546	---	---
Continental Oil Co. of Venezuela.	Continental Oil Co	United States	797	4,909	---
Coro Petroleum Co	Texaco Inc	do	70,865	4,130	---
Creole Petroleum Corp	Standard Oil Co. (New Jersey).	do	651,833	552,570	544
International Petroleum Co., Ltd.	do	do	6,133	---	---
King Mill Oil Co., C.A.	King Mill Oil Co	do	4,970	---	---
Mene Grande Oil Co., C.A.	Gulf Oil Corp	do	600,227	145,305	---
Mito Juan Concesionaria de Hidrocarburos.	Venezuelan investors	Venezuelan	6,776	---	---
Mobil Oil Co. de Venezuela.	Mobil Oil Corp	United States	156,159	45,372	97
Pan American Venezuelan Oil Co.	Standard Oil Co. (Indiana).	do	5,500	---	---
Phillips Petroleum Co	Phillips Petroleum Co.	do	45,470	20,456	4
Signal Oil and Gas of Venezuela.	Signal Companies, Inc.	do	7,892	3,970	---
Sinclair Venezuelan Oil Co.	Sinclair Oil Corp	do	166,647	24,102	43
Sociedad Anónima Petrolera Las Mercedes (PETMER).	Texaco Inc. and Ultramar Co., Ltd.	United States/ British.	63,026	1,577	---
Talon Petroleum Co., C.A.	Kirby Petroleum Co	United States	60,167	1,367	---
Texaco Maracaibo, Inc	Texaco Inc	do	3,147	35,429	---
Texas Petroleum Co	do	do	155,260	25,704	10
Venezuelan American Independent Oil Producers Association, Inc.	Atlantic Richfield Co., Sun Oil Co., Texaco Inc.	do	841	---	---
Venezuelan Atlantic Refining Co.	Atlantic Richfield Co.	do	28,072	---	---
Venezuelan Gulf Refining Co.	Gulf Oil Corp	do	---	---	159
Venezuelan Sun Oil Co	Sun Oil Co	do	20,000	88,506	---
Total private companies			2,542,499	1,313,151	1,333
Venezuelan Government Corporacion Venezolano de Petróleo (C.V.P.)			699,247	6,189	16
Grand total			3,241,746	1,319,340	1,349

[1] To private companies.
[2] To the Government.

Source: Ministerio de Minas e Hidrocarburos, Venezuela. Memoria y Cuenta, Año 1968, Caracas, Venezuela, March 1969.

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The Mineral Industry of Yugoslavia

By Roman V. Sondermayer [1]

During 1968 Yugoslavia remained one of Europe's leading producers of nonferrous ores and metals. Bauxite, chromite, and ores of antimony, copper, silver, and zinc and nonmetals such as barite, feldspar, magnesite, and pyrite were among important minerals produced. Mineral fuels included modest quantities of coals (mostly lignite), crude oil, and natural gas. Power shortages, among other factors, adversely influenced mineral production.

The mineral industry contributed close to 17 percent to the gross national product of Yugoslavia and employed about 6 percent of the total work force in 1968. Although a significant exporter of minerals, Yugoslavia had a negative trade balance in mineral commodities during 1967, the last year for which trade data are available. A similar trade deficit may have existed in 1968 as no significant changes in mineral trade were expected.

New economic measures imposed by the Government requires consolidation of operating mines and increased productivity, and closing of small mines. Limitations on investments slowed down opening of new mines and construction of new plants for processing minerals, but on the other hand resulted in better utilization of existing facilities.

The principal events in the mineral industry were agreements with the French company Pechiney to build an aluminum plant at Titograd and an alumina plant at Mostar; completion of two refineries at Novi Sad and Pančevo complemented with the reconstruction of the refinery near Bosanski Brod; and mergers of coal mines in Bosnia.

PRODUCTION

During 1968 the policy of tight investments continued. Consequently, to maintain or increase mineral output producers directed their efforts toward better utilization of existing facilities rather than construction of new ores. The closing of unprofitable mines and the conversion to opencast mining whenever possible was common. Mechanization both underground and open cast mines proceeded at a more rapid pace than in 1967. Exceptionally high productivity per loader was obtained at the Majdanpek open pit, where about 12,500 tons of ore and waste was handled in single 8-hour shift with one 9 yard loader. In spite of high productivity at open cast copper mines, productivity per man-shift of Yugoslav miners was lower than productivity of miners in Western Europe.

Petroleum exploration, production, and refining, although modest by world standards, were generally performed by modern and efficient methods. All three primary methods of oil production (flowing, pumping, and gas lifting) were used and secondary recovery methods (repressuring and waterflooding) were employed at older fields in Yugoslavia. Chemical and hydraulic methods for stimulation of crude oil production were widely used during 1968.

[1] Foreign mineral specialist, Division of International Activities.

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Table 1.—Yugoslavia: Production of selected mineral and metal commodities [1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968p
METALS					
Aluminum:					
Bauxite, gross weight—thousand tons	1,293	1,574	1,887	2,131	2,072
Alumina, gross weight	87,912	95,424	95,299	r 101,408	• 102,000
Metal, including secondary	34,763	41,318	42,022	44,574	48,080
Antimony:					
Mine output, metal content	NA	3,969	3,607	3,079	• 2,700
Metal (regulus)	2,729	2,768	2,645	2,297	1,755
Bismuth, metal [2]	84	88	103	107	86
Cadmium, metal [2 e]	41	41	41	150	150
Chromium, chromite, gross weight	88,358	79,851	54,211	47,162	• 47,000
Copper:					
Mine output, metal content	63,184	62,551	62,222	r 63,152	• 64,000
Blister including secondary	51,716	56,919	71,341	r 76,707	• 77,000
Refined (electrolytic):					
Primary	51,941	56,354	49,068	50,635	59,421
Secondary			13,852	15,554	10,633
Gold [3]—troy ounces	106,773	103,911	84,942	68,064	NA
Iron and steel:					
Iron ore and concentrate—thousand tons	2,307	2,504	2,493	2,580	2,720
Pig iron—do	1,026	1,115	1,143	1,177	1,201
Ferroalloys, all types—do	50	60	74	79	85
Steel ingots and castings—do	1,677	1,769	1,867	1,832	1,997
Semimanufactures—do	1,204	1,188	1,226	1,176	1,510
Lead:					
Mine output, metal content of ore	113,105	106,251	102,600	r 108,079	• 110,000
Metal:					
Smelter, crude, including secondary	117,224	116,166	r 111,923	r 101,890	• 104,000
Refined, including secondary	101,085	101,576	r 97,803	r 98,805	94,833
Manganese, ore and concentrate, gross weight	7,784	8,097	8,616	9,821	NA
Mercury—76-pound flasks	17,318	16,419	15,896	15,890	14,794
Selenium, elemental—kilograms	3,828	7,911	9,325	r 4,644	NA
Silver [2] metal, including secondary—thousand troy ounces	4,037	4,148	3,651	3,075	2,577
Zinc:					
Mine output, metal content	91,801	91,819	85,241	r 90,017	• 100,000
Metal, including secondary	44,512	46,065	51,089	53,188	78,978
NONMETALS					
Asbestos	8,419	9,603	7,630	9,021	10,393
Barite	101,670	97,110	80,189	r 84,478	• 86,000
Cement, hydraulic—thousand tons	3,039	3,103	3,232	3,313	3,765
Clays, fire clay:					
Crude	232,354	245,080	247,244	r 168,004	• 170,000
Burned	43,520	46,590	46,314	r 34,667	• 35,000
Feldspar, crude	33,794	55,935	41,570	36,996	• 35,000
Fertilizer materials, manufactured:					
Nitrogenous:					
Gross weight—thousand tons	421	461	499	r 505	661
Nitrogen content [4]—do	84	92	100	101	132
Phosphatic:					
Gross weight—do	968	801	1,012	r 1,235	1,072
P_2O_5 content [5]—do	160	132	167	204	172
Gypsum:					
Crude	154,739	167,204	168,694	r 170,925	• 171,000
Calcined	44,314	40,260	40,968	r 43,747	• 44,000
Lime:					
Quicklime—thousand tons	907	1,113	1,138	1,199	• 1,200
Hydrated lime—do	129	166	190	r 258	• 260
Magnesite:					
Crude	497,420	525,941	526,685	r 424,762	400,316
Sintered	177,933	195,880	188,807	r 194,516	156,301
Caustic calcined	32,068	28,168	25,631	r 17,807	NA
Mica, all grades—kilograms	11,666	53,890	54,630	118,659	NA
Pyrites:					
Gross weight	427,802	406,773	378,134	r 424,648	274,000
Sulfur content	179,677	170,845	158,816	178,352	115,000
Quartz, quartzite, and glass sand—thousand tons	NA	533	605	629	NA
Salt:					
Marine	52,748	40,338	34,283	r 40,776	179.000
Brine	131,230	133,241	130,221	127,656	
Stone, sand and gravel:					
Gravel and sand, excluding glass sand—thousand cubic meters	4,997	5,063	5,453	6,092	NA
Dimension stone and marble facing—square meters	317,705	301,988	385,496	305,527	NA

See footnotes at end of table.

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Table 1.—Yugoslavia: Production of selected mineral and metal commodities [1]—Continued

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
MINERAL FUELS AND RELATED MATERIALS					
Carbon black	4,907	5,099	6,560	r 12,423	e 12,500
Coal:					
Bituminous thousand tons	1,262	1,169	1,150	908	835
Brown do	10,715	10,509	10,079	9,023	9,508
Lignite do	17,584	18,279	18,080	16,535	16,389
Coke:					
Metallurgical do	1,089	1,153	1,165	r 1,157	
Breeze do	70	100	62	r 62	1,233
Gaswork do	17	14	11	r 7	
Fuel briquets, all grades	3,963	22,667	23,215	23,909	24,000
Gas:					
Manufactured (city gas only) million cubic feet	2,144	2,263	2,212	2,413	NA
Natural, gross production do	10,224	12,317	14,207	16,313	20,615
Petroleum:					
Crude oil thousand tons	1,799	2,063	2,222	2,374	2,494
Refinery products:					
Gasoline do	385	546	788	886	935
Kerosine and jet fuels do	98	82	94	94	119
Distillate fuel oils do	701	890	1,142	1,389	1,380
Residual fuel oils do	683	1,148	1,764	1,816	1,847
Lubricants do	126	134	160	r 138	103
Asphalt and bitumen including natural thousand tons	151	112	140	r 171	245
White spirits	16,084	15,619	16,288	16,870	17,871

e Estimated. p Preliminary. r Revised.
[1] In addition, Yugoslavia produced in 1968 bentonite, germanium, kaolin, liquefied and blast furnace gases, and petroleum coke but statistics were not available.
[2] All as byproduct of lead and zinc production.
[3] Most as byproduct of copper production.
[4] Calculated on basis of 20 percent N content as reported in source material.
[5] Calculated on basis of 16.5 percent P_2O_5 content as reported in source material.

TRADE

Data on Yugoslavia's 1968 foreign trade were not available for inclusion in this chapter. However, the share of minerals in relation to total trade was believed to be similar to that of 1966 and 1967 which is as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	204.1	1,220.1
1967	232.1	1,251.6
Imports:		
1966	366.4	1,575.4
1967	380.4	1,707.3

West Germany was the largest importer of Yugoslavia's minerals and the U.S.S.R. the largest supplier. Value of mineral exports to West Germany in 1967 totaled $26.1 million and imports from the U.S.S.R. in the same year totaled $72.1 million. Nonferrous metals were the largest commodity group among Yugoslavia's mineral exports during 1967. Iron and steel products accounted for the largest part of the country's 1967 mineral imports ($137.6 million) followed by petroleum and its products ($59.1 million).

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Table 2.—Yugoslavia Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite—thousand tons	1,492	1,813	U.S.S.R. 631; West Germany 587; Italy 275.
Oxide and hydroxide (alumina only)	13,020	11,568	Austria 7,642; Hungary 2,798.
Metal, including alloys:			
Scrap	148	158	Italy 99; West Germany 56.
Unwrought	1,678	6,324	Italy 3,306; Colombia 2,900.
Semimanufactures	18,127	18,431	United States 5,423; Poland 3,155.
Antimony metal, including alloys, all forms	2,012	1,747	United States 949; Poland 515.
Bismuth metal, including alloys, all forms	47	65	West Germany 33; United Kingdom 12.
Cadmium metal, including alloys, all forms	NA	12	Italy 8.
Chromium, chromite, concentrates	13,070	6,920	All to Czechoslovakia.
Copper: metal, including alloys:			
Scrap and filings	543	437	All to Italy.
Unwrought (electrolytic only)	179	1,419	United States 1,400.
Semimanufactures	31,859	29,160	U.S.S.R. 5,166; Italy 4,824; United States 3,468.
Iron and steel:			
Ore and concentrate, except roasted pyrite.	-------	91,154	All to Rumania.
Roasted pyrite	-------	524	All to Austria.
Metal:			
Scrap	9,383	42,355	Italy 32,958; West Germany 6,674.
Pig iron, ferroalloys and similar materials.	32,886	116,084	Japan 64,174; United States 19,565.
Steel, primary forms (blooms, billets, slabs).	1,942	10,042	Italy 10,039.
Semimanufactures:			
Bars, rods, shapes, sections	67,840	98,030	U.S.S.R. 42,237; Italy 11,620; Poland 10,826.
Universal plates and sheets	13,737	15,591	Italy 6,817; West Germany 4,755; Albania 2,725.
Hoop and strip	560	779	Rumania 300; Italy 265.
Rails and accessories	37,300	38,020	Rumania 31,139; Italy 5,893.
Wire (excluding wire rods)	6,176	12,366	Iran 3,476; Burma 2,997; Switzerland 1,650.
Tubes, pipes and fittings	88,694	73,378	East Germany 18,775; Czechoslovakia 10,142; Tanzania 9,196; Italy 8,037.
Castings and forgings, rough	10,388	9,013	Poland 3,090; East Germany 3,026; West Germany 1,598.
Lead, metal including alloys:			
Unwrought (all kinds)	59,108	54,641	United States 27,204; U.S.S.R. 10,741; Austria 7,459.
Semimanufactures	2,346	1,547	Italy 897; United Kingdom 327.
Manganese, ore and concentrate	-------	990	All to U.S.S.R.
Mercury—76-pound flasks	14,214	14,678	United States 5,716; United Kingdom 3,132; U.S.S.R. 2,900; West Germany 2,089.
Nickel, metal, including alloys, scrap	-------	60	West Germany 27; United Kingdom 20; Austria 13.
Platinum group metals, kilograms—paladium.	-------	237	Netherlands 102; Switzerland 95.
Selenium, elemental—do	-------	4,735	West Germany, 3,083; United Kingdom 1,352.
Silver, metal, including alloys, all forms	-------	81	West Germany 77.
Titanium, including alloys, all forms	-------	54	All to Netherlands.
Zinc:			
Ore and concentrate	10,754	2,836	Italy 1,518; Poland 1,317.
Oxide	809	1,223	Rumania 815; Italy 213.
Metal, including alloys:			
Powder and flakes	1,565	2,992	Czechoslovakia 1,341; West Germany 790; Austria 360.
Unwrought	5,325	5,218	United Kingdom 1,829; Italy 1,623; Czechoslovakia 1,020.
Semimanufactures	8,636	7,659	West Germany 3,421; France 2,016.
NONMETALS			
Asbestos	1,723	1,660	United States 1,596.
Barite, crude and ground	47,883	45,028	U.S.S.R. 23,259; Hungary 12,651.
Cement:			
Portland	143,132	143,874	Kuwait 39,847; Libya 34,000; Ghana 29,120; Malta 27,782.
Other	46,128	18,472	Saudi Arabia 5,920; Italy 3,962; United States 3,012.

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Table 2.—Yugoslavia: Exports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Clays and clay products (including refractory brick):			
Crude clays, n.e.s.:			
Bentonite	13,699	26,284	Czechoslovakia 9,809; Sweden 6,515; East Germany 5,191; Poland 3,260.
Fire clay	1,478	4,220	Italy 4,205.
Kaolin (china clay)	23,370	91	Italy 49; Switzerland 40.
Other	61	780	All to U.S.S.R.
Products (including all kinds of bricks):			
Refractory	48,791	48,923	Rumania 17,385; Poland 9,940; West Germany 6,742.
Nonrefractory	8,777	184,295	Hungary 176,634; West Germany 1,226.
Diatomite	3,561	1,667	Greece 818; Netherlands 626; Switzerland 191.
Feldspar	20,379	20,630	East Germany 7,941; Poland 7,620; Hungary 2,647.
Fertilizer materials, manufactured:			
Nitrogenous	6,020	1,361	Switzerland 761; Czechoslovakia 300; West Germany 300.
Phosphatic	354,481	288,603	Bulgaria 260,384; Turkey 25,000.
Gypsum and plaster	160	191	All to Greece.
Lime	1,360	1,578	All to Italy.
Magnesite:			
Crude	2,855	3,580	Ireland 1,950; Poland 1,595.
Calcined	17,068	12,378	Netherlands 4,431; Poland 3,917; East Germany 2,749.
Sintered	83,088	68,517	Italy 19,600; United States 17,007.
Pyrites, gross weight	190,161	96,406	United Arab Republic 68,230; Czechoslovakia 14,690.
Stone, sand and gravel:			
Dimension stone, all kinds	41,320	51,462	Netherlands 28,341; Austria 9,089.
Gravel and crushed rock	5,213	6,632	Austria 6,563.
Sand, excluding metal bearing	4,520	4,646	All to Italy.
Sulfur:			
Elemental, all forms	1,502	1,602	All to United Kingdom.
Sulfuric acid	7,321	8,087	Italy 4,121; Austria 2,811.
Talc, all forms	6	5	All to Austria.
MINERAL FUELS AND RELATED MATERIALS			
Carbon black and gas carbon	1,310	668	East Germany 410; Bulgaria 195.
Coal:			
Bituminous	3,567	2,269	Greece 1,500; Austria 468.
Dust	81,332	84,968	Italy 83,300.
Brown	4,392	16,064	Austria 16,024.
Dust	20	-------	
Lignite	23,852	30,362	Italy 29,800.
Gas, liquefied, all kinds	6,312	10,844	Italy 5,530; Austria 5,312.
Petroleum:			
Crude and partly refined	324,017	321,805	Austria 321,803.
Refinery products:			
Gasoline, all kinds	181,533	91,204	United Kingdom 58,839; Italy 16,033.
Jet fuel	13,308	13,732	United Kingdom 4,183; U.S.S.R. 1,592.
Distillate fuel oils	286,707	276,418	Italy 95,361; United Kingdom 93,957.
Residual fuel oils	317,094	270,479	Italy 195,443; Austria 28,716.
Lubricants	43,551	55,170	India 55,023.
Mineral jelly and wax	-------	132	Netherlands 70; Italy 62.
Other products	819	9,202	Hungary 9,159.
Total	843,012	716,337	

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Table 3.—Yugoslavia: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite ore and concentrates	7,155	7,816	Guyana 3,679; United States 3,607.
Alumina	---	3,449	France 3,171.
Metal, including alloys:			
Unwrought	26,119	25,299	U.S.S.R. 23,680; United States 1,107.
Semimanufactures	1,207	2,783	West Germany 1,814; Austria 417.
Antimony:			
Ore and concentrate	163	---	
Metal, including alloys, all forms	---	105	United Kingdom 90; mainland China 15.
Chromium:			
Chromite	40,168	43,963	All from Albania.
Oxide and hydroxide	167	353	Netherlands 180; Hungary 81; West Germany 44.
Metal, including alloys, all forms	---	7	United Kingdom 6.
Cobalt:			
Oxide and hydroxide	19	24	United Kingdom 20.
Metal, including alloys, all forms	29	29	Belgium 28.
Columbium and tantalum, metal, including alloys, tantalum, kilograms	---	8	Austria 5.
Copper:			
Ore and concentrate	---	497	All from United Kingdom.
Metal including alloys:			
Scrap	4,285	1,490	United States 1,346.
Unwrought:			
Blister and other unrefined forms.	5,910	609	All from United Kingdom.
Refined and alloys	9,500	15,588	United Kingdom 13,014.
Semimanufactures	4,915	5,486	Chile, 2,426; West Germany 1,009.
Iron and steel:			
Ore and concentrate	393,107	128,206	India 112,286; Sudan 13,550.
Metal:			
Scrap	120,388	25,702	West Germany 9,481; Austria 7,006; Tunisia 4,881.
Pig iron including cast iron	245,683	140,844	U.S.S.R. 105,691; Czechoslovakia 21,535.
Sponge iron, powder and shot	641	740	Sweden 497; United Kingdom 96.
Ferroalloys:			
Ferromanganese	270	2,108	Bulgaria 1,374; West Germany 319.
Other	1,310	1,094	U.S.S.R. 435; West Germany 287; Austria 159.
Steel primary forms:			
Ingots	55,016	24,276	All from Rumania.
Blooms, billets, slabs		61,091	Bulgaria 31,578; U.S.S.R. 29,121.
Semimanufactures:			
Bars, rods, shapes, sections	185,503	209,276	Czechoslovakia 41,818; U.S.S.R. 39,130.
Universal plates and sheets	478,818	448,103	West Germany 80,828; Italy 80,362; U.S.S.R. 60,148; France 50,652.
Hoop and strip	74,897	74,641	Czechoslovakia 39,369; Italy 7,218.
Rails and accessories	3,364	2,311	West Germany 1,513; U.S.S.R. 387; Australia 357.
Wire	32,612	26,467	Czechoslovakia 10,506; West Germany 5,543.
Tubes, pipes, and fittings	45,984	40,217	Czechoslovakia 10,767; Hungary 8,011; West Germany 7,754; Italy 4,645.
Castings and forgings	2,184	1,858	West Germany 660; Poland 383; Austria 338; Czechoslovakia 205; Italy 202.
Lead:			
Ore and concentrate	12,737	6,783	Morocco 3,875; Poland 1,017; West Germany 1,001; Switzerland 891.
Oxides	10	530	West Germany 398; Netherlands 69.
Metal, including alloys:			
Scrap	3,468	1,768	Cyprus 303; Kuwait 290; Tanzania 201; Nigeria 176.
Unwrought	1,589	8,385	Bulgaria 4,450; United Kingdom 1,517; Switzerland 1,282.
Semimanufactures	---	244	West Germany 238; France 2.
Manganese:			
Ore and concentrate	35,056	49,032	U.S.S.R. 38,602; India 5,505.
Oxides	226	395	Netherlands 190; Japan 160.
Metal, unwrought	111	51	U.S.S.R. 26; United Kingdom 12; Italy 10.
Mercury, 76-pound flasks	---	9	West Germany 8.
Nickel:			
Matte, speiss, and similar materials	---	18	All from United States.
Metal, including alloys:			
Unwrought	514	214	United Kingdom 105; Netherlands 57; West Germany 40.
Semimanufactures	123	119	West Germany 98; Sweden 8.

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Table 3.—Yugoslavia: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Platinum—troy ounces	23,759	19,612	U.S.S.R. 19,130; West Germany 418.
Silver—do	116,064	433,874	West Germany 215,538; Austria 83,720; Netherlands 46,104; United Kingdom 43,403.
Selenium, elemental—kilograms	1,752	840	All from West Germany.
Tin:			
Oxides—long tons	19	11	All from West Germany.
Metal, including alloys:			
Unwrought—do	1,377	1,793	United Kingdom 687; Malasia 272; West Germany 225.
Semimanufactures—do	35	28	Mainly from West Germany.
Titanium:			
Ore and concentrate	1,870	1,699	Australia 1,208; United Kingdom 308; West Germany 160.
Oxides	2,744	3,925	West Germany 2,496; Italy 799.
Metal, including alloys—kilograms	----------	250	U.S.S.R. 105; Italy 91; West Germany 40.
Tungsten, metal including alloys, all forms	40	11	West Germany 6; United Kingdom 3; France 2.
Zinc:			
Ore and concentrate	1,008	21,754	Czechoslovakia 13,326; Italy 6,928.
Oxides	721	245	Italy 131; West Germany 57; Austria 50.
Metal, including alloys:			
Scrap	----------	20	All from West Germany.
Unwrought	1,672	2,233	Bulgaria 791; Rumania 500; Netherlands 415; West Germany 304.
Semimanufactures	245	334	All from West Germany.
Other ash and residues containing nonferrous metals.	53	2,160	Thailand 2,071; United Kingdom 89.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum	463	695	Italy 454; West Germany 132.
Dust and powder of precious and semiprecious stone.—kilograms	13	29	Austria 12; Denmark 11.
Grinding and polishing wheels and stones.	872	623	Austria 401; West Germany 83.
Asbestos	13,376	18,644	U.S.S.R. 10,733; Canada 4,357; Botswana 2,271.
Boron materials:			
Crude natural borates	1,373	1,850	All from Turkey.
Oxides and acid	559	285	U.S.S.R. 100; Poland 75; France 47; Italy 44.
Cement	573,666	990,106	Rumania 440,627; Hungary 190,459; Czechoslovakia 157,084.
Chalk	157	522	East Germany 475.
Clay and clay products:			
Crude clays:			
Bentonite	----------	30	France 17; Austria 7.
Fireclay	41,732	34,666	Czechoslovakia 25,430; Poland 8,151.
Fuller's earth, dinas, chamotte	141	158	Italy 130.
Kaolin	23,370	26,515	Czechoslovakia 16,674; East Germany 4,716.
Other	156	378	East Germany 170; Czechoslovakia 50; West Germany 50.
Products:			
Refractory (including nonclay bricks).	11,873	12,400	West Germany 6,988; U.S.S.R. 1,944.
Nonrefractory	2,872	22,804	Italy 18,063; Poland 2,766.
Diamond, industrial—kilograms	50	74	Austria 64.
Diatomite and other infusorial earth	330	594	Austria 364; United States 165.
Fertilizer materials:			
Crude:			
Phosphatic	688,281	694,245	Tunisia 208,787; United Arab Republic 130,181; Jordan 126,368; United States 14,347.
Potassic	----------	3,325	All from East Germany.
Manufactured:			
Nitrogenous	422,861	433,809	Austria 115,384; West Germany 76,457; France 72,500; U.S.S.R. 58,261.
Phosphatic:			
Thomas slag	11,300	62,925	West Germany 38,925; United Arab Republic 24,000.
Other	3	6,095	Mainly from Netherlands.
Potassic	309,800	175,466	West Germany 89,941; U.S.S.R. 79,015.

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Table 3.—Yugoslavia: Imports of selected mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Fluorspar	711	1,193	East Germany 935; Bulgaria 243.
Graphite, natural	934	1,141	Austria 537; West Germany 280; U.S.S.R. 198.
Mica:			
Crude, including splittings and waste	7	536	Italy 465.
Worked, including agglomerated splittings.	37	35	Italy 14; Switzerland 10.
Precious and semiprecious stone, except diamond	532	130	West Germany 41; Switzerland 41; France 20.
Pyrite	1	20	All from Hungary.
Salt	166,615	123,710	Rumania 84,132; United Arab Republic 26,079; Tunisia 13,379.
Sodium and potassium compounds:			
Caustic soda	9,526	14,801	Italy 7,107; West Germany 5,434.
Caustic potash, sodic and potassic peroxides.	771	618	France 250; East Germany 238; Poland 110.
Stone, sand and gravel:			
Dolomite, chiefly refractory grade	2,355	2,787	Mainly from Italy.
Gravel and crushed rock	38	15,144	Mainly from Hungary.
Limestone, except dimension	----------	11,511	All from Hungary.
Quartz and quartzite	356	718	Hungary 500; West Germany 115.
Sand, excluding metal bearing	3,767	11,427	East Germany 3,930; Netherlands 2,086.
Sulfur:			
Elemental, all forms	14,423	21,237	France 12,478; Greece 5,635.
Sulfuric acid	595	448	Bulgaria 416; Italy 24.
Talc, steatite, soapstone, and pyrophylite	1,604	668	Italy 277; Czechoslovakia 144; Austria 89.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,337	4,424	Rumania 4,214.
Carbon black and gas carbon	7,688	3,974	Italy 2,671; U.S.S.R. 992.
Coal and briquets:			
Anthracite and bituminous coal	1,822,918	1,444,588	U.S.S.R. 902,910; United States 446,492.
Briquets of anthracite and bituminous coal.	13,131	22,004	All from U.S.S.R.
Coke and semicoke	198,137	114,384	Czechoslovakia 31,808; West Germany 21,368; United Kingdom 20,050; Austria 19,688.
Petroleum:			
Crude and partly refined	2,202,197	2,589,524	U.S.S.R. 675,394; Libya 537,332; Iran 503,419; Iraq 500,359.
Refinery products:			
Gasoline (including natural)	29,753	26,838	U.S.S.R. 10,258; Italy 9,427; United Kingdom 7,147.
Kerosine and jet fuel	8,710	13,235	Mainly from U.S.S.R.
Distillate fuels	117,549	303,872	U.S.S.R. 197,563; Rumania 54,562.
Residual fuel oil	67,024	264,967	U.S.S.R. 205,664; Rumania 25,241.
Lubricants	47,731	36,615	Rumania 14,487; U.S.S.R. 5,342; Italy 5,244.
Mineral jelly and wax	7,043	4,176	Rumania 1,357; West Germany 1,166; U.S.S.R. 517.
Other	107,516	53,140	Hungary 29,086; Venezuela 12,657; Poland 5,696.
Total	385,326	702,843	

COMMODITY REVIEW

METALS

Aluminum.—Although no major bauxite deposits were found, and the disparity between output of bauxite and aluminum continued, the Yugoslavs were negotiating three projects which, provided the necessary financial backing is secured, would raise production capacity to 200,000 tons of aluminum and 400,000 tons of alumina per year by the end of the 5-year period 1970–75.

Construction of an alumina-aluminum plant at Titograd, began in 1967, was speeded up after contract agreement was reached with the French company Pechiney (Compagnie des Produits Chimiques et Electrometallurgiques) the plant is now scheduled to go on stream in 1972. Annual

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capacity is set at 200,000 tons of alumina and 50,000 tons of aluminum.

Pechiney also was to provide technical know-how for the establishment of an alumina plant at Mostar. This plant, to be managed by the Energo-Invest of Sarajevo, will have a capacity of 200,000 tons of alumina per year, with the possibility of adding facilities to produce 50,000 tons per year of aluminum. Financing for the aluminum smelter, however, had not been arranged at yearend.

The Yugoslav Government was also considering establishment of a 50,000-ton-per-year aluminum smelter at Šibenik. However, as yet no guarantees of foreign credit have been secured, and the project is therefore still in the planning stages.

Copper.—The first stage of Bor Copper Combine expansion was completed during 1968. The new 150,000 ton per year sulfuric acid plant at Bor was completed in August. The plant will use smelter gases from the copper smelter and most of the acid produced will be used in the fertilizer plant at Prahovo.

A new flotation plant was added to the existing one at Majdanpek. Capacity of the expanded flotation plant is 6.3 million tons of copper ore per year.

The second phase of expansion of copper producing facilities at Bor and Majdanpek continued in 1968. When completed in 1972, annual electrolytic copper output at Bor will reach 95,000 tons, and copper ore production at the Majdanpek open pit will be increased to 11 million tons per year. Completion of this second phase apparently will end the necessity of importing copper metal into Yugoslavia. However, imports of concentrates will continue, and therefore Yugoslavs were negotiating with Chilean firms a joint venture to exploit copper deposits located in southern Chile.

Iron and Steel.—After more than a year of negotiation, enterprises involved in producing iron and steel in Bosnia and Hercegovina were merged into one large enterprise. The Zenica iron and steel plant, Ilijaš ironworks, and the iron ore mines at Ljubija and Vareš will be combined as of January 1969.

Reconstruction and modernization of existing iron and steel plants continued throughout the year. Planned expansion of annual steel output to 3.2 million tons by 1970 will not be attained principally because of difficulties in financing the projects.[2]

Early in the spring 1968 an agreement was concluded between a U.S.S.R. export firm and a Yugoslav foreign trade enterprise to supply soviet steel making equipment and continuous casting facilities for expansion of Zenica iron and steel plant. The value of the contract is $16 million and will be financed by the U.S.S.R. Deliveries of equipment will start in 1969. Modernization of the steel plant is to be completed by 1972 when annual output should reach 2 million tons, double the present output.

Lead and Zinc.—The Stari Trg mine near Zvečan, Kišnica mine near Priština, Srebrenicamine in Bosnia and Hercegovina, Kopaonik mine in Serbia, and Majkovac mine in Montenegro, were modernizing production and beneficiation facilities for lead and zinc ores during 1968.

Following the expansion of zinc smelting capacity, domestic mine output was not adequate to satisfy demand thus imports of zinc concentrates were necessary.

A backlog developed at the Zvečan lead refinery after a new smelter was completed in 1967. Steps were taken to finance expansion of the lead refinery, but at yearend 1968 no firm evidence of financial arrangements was available.

The construction of a lead-zinc smelter at Titov Veles proceded slowly during 1968 because of inadequate finances. Although various capacity figures for the smelter have been reported, latest published data indicated a production of 75,000 tons of lead, 52,000 tons of zinc, and 120,000 tons of sulfuric acid by 1972.

Titanium.—The representatives of the zinc plant near Celje in Slovenia and representatives of East Germany's enterprise Lacke and Farben, from East Berlin, concluded an agreement to build new facilities for production of 20,000 tons of titanium dioxide per year at Celje. The agreement is one of the first concluded after the law on foreign investments was enacted in Yugoslavia. Celje will provide 51 percent of the total investment and the rest will be invested by the East German partner.

[2] Privredni Pregled, Feb. 27, 1969, pp. 3.

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NONMETALS

The nonmetals industry of Yugoslavia produced a large variety of commodities but there were no new capital investments. Cement, magnesite, and salt were the most important products in the nonmetals sector.

Cement.—Modernization of cement industry continued during 1968. At the Usje cement plant near Skopje in Macedonia a new section with an annual capacity of 380,000 tons of cement went on stream, bringing total capacity up to 580,000 tons per year. Equipment and technology were purchased from the Belgian company Ateliers Louis Carton and the West Germany firm, Polysius.

At the Popovac cement plant, reconstruction continued and the first phase was completed at yearend. Approximate capacity of the new addition is about 100,000 tons. All scheduled work was completed in 1968 except for the installation of electrical dust filters. The Trbovlje cement plant in Slovenija started a program of modernization in 1968. Plans call for an additional capacity of 380,000 tons of cement. When completed in 1971, the Trbovlje plant will have an annual capacity of 580,000 tons of cement.

Fertilizers.—In addition to the old plant, Prahovo now has three new units; namely, a superphosphate plant (100,000 tons per year), phosphoric acid plant (120,000 tons per year), and a natrium tripol phosphate plant (20,000 tons per year).

Magnesite.—Facilities for magnesite production were modernized and expanded. At the Goleš mine a new separation plant was under construction, however, details on capacity were lacking. At the Strezovac magnesite mine near Kosovska Kamenica new capacities were developed that doubled magnesite production from 35,000 tons to 70,000 tons per year.

Salt.—Development of the first rock salt mine Tusanj near Tuzla in Bosnia was completed at yearend 1967, and in October 1968 after 10 months of trials, production started. When operating at full capacity the mine will produce 150,000 tons of rock salt per year.

At salina near Ulcinj in Montenegro, new facilities for thermal evaporation of brine will replace solar evaporation. This salina will have a capacity of about 100,000 tons of salt per year, compared with current output of about 30,000 tons.

MINERAL FUELS

Liquid fuels and natural gas made important inroads in the energy market and started to become significant components of the country's fuel consumption. In addition, the new economic system led to larger consumption of imported solid fuels, and imported and domestic liquid fuels. This trend was adversely affecting the country's coal industry, even though coal remained the principal energy source. To protect the coal mines, the Government increased the price of liquid fuels in 1968.

Coal.—The domestic coal industry, artificially supported in the past under centralized economic planning, was making every effort to operate on a more competitive basis. Some small mines were closed, production at others was reduced, and some miners were laid off. Only highly productive units could continue to operate under the new rules of competition. It was decided to merge the Kreka and Banovići lignite mines in Bosnia and at yearend preparations for merger were completed except for the legal aspects. The central Bosnian mines, Kakanj, Zenica, Breza, and Bila, will also operate as one enterprise beginning January 1, 1969.

The bulk of coal reserves in Yugoslavia consists of low calorific value lignite. In order to utilize these reserves and to help meet requirements for electric power, the government has initiated a program for construction of added mine-mouth electric power stations.

During 1968 extensive exploration started on bituminous coal deposits at Podbrdje near Kraljevo in Serbia. The exploration was carried out by the Tbarski Rudnici (Ibar Mines) Enterprise, which operates bituminous coal mines in the vicinity. At yearend total new bituminous coal reserves in the Podbrdje area amounted to 1.5 million tons. At Tadonje an additional 1.5 million tons of bituminous coal was reported.

Development of the Kosova Mining, Power, and Chemical Combine at Obilić based on lignite continued during 1968. Construction of a manufactured gas pipeline toward Skopje was close to completion at yearend. The pipeline is about 50 kilom-

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eters long and connects the gasworks at Obilić (based on lignite) with steelworks at Skopje.

Petroleum and Natural Gas.—The petroleum industry had a successful year in 1968, new refineries at Pančevo and Novi Sad went on stream, and reconstruction of the refinery at Bosanski Brod was completed in the fall. The new refineries and expansion of the existing one increased petroleum throughput capacity to about 8 million tons of crude oil per year.

During 1968 Industrija Nafte (INA) was by far the largest oil enterprise in Yugoslavia, operating oil fields in Croatia and Slovenia and refineries at Sisak and Rijeka. INA produced about 71 percent of the country's crude oil output and close to 52 percent of the petroleum refineries products. INA also drilled 165,000 meters in 1968 with 11 rigs or an average of 15,000 meters per year rig. The bulk of the drilling was within the Pannonian Basin of northern Yugoslavia, with additional exploration drilling in Dalamcia on the Adriatic Sea. INA explorating activities in the Adriatic Sea will probably include off shore drilling by 1970, with production scheduled for 1975.

Naftagas, the other leading Yugoslav oil producer, operated oil fields in Serbia, explored for oil in Macedonia and completed construction of Pančevo and Novi Sad refineries.

Nafatagas also drilled in Pannonian Basin with additional drilling in Macedonia. Naftagas drilled about 63,000 meters with 7 rigs, or 9,000 meters per year rig, during 1968. The exploration in Macedonia apparently was successful at Ovče Polje, where reports indicated discovery of oil on well number 1. However details on depth and formation age were withheld.

After 6 years of construction the Pančevo refinery with a capacity of 1.2 million tons per year was completed at the year end 1968. The Novi Sad refinery which is only a distillating plant was completed in July. This plant has a capacity of 600,000 tons of crude oil per year. Production started in fall and the plant in Novi Sad will be operated as part of Pančevo refinery.

The reconstruction of the Bosanski Brod refinery, an independent enterprise, was completed in the fall, raising capacity to 2.1 million tons of crude oil annually.

The construction of the 685-kilometer pipeline within Yugoslavia, to connect the Danube port terminal and Rijeka port with Yugoslavia's refineries continued during 1968. The first section, 106 kilometers long, connecting Opatovac on the Danube with the refinery at Bosanski Brod, was completed in fall 1968. The future of two other sections of the pipeline Bakar-Sisak and Sisak-Bosanski Brod is not clear. Financial difficulties compounded with uncertainties of Czechoslovakian and Hungarian cooperation in use of the pipeline may postpone construction.

Natural Gas.—The production of and consumption of natural gas increased in 1968. New facilities handling liquefied natural gas and liquefied petroleum gas were constructed. In addition plans for a gas trunk pipeline connecting Subotico, Novi Sad and Beograd were completed. The pipeline will be built by Naftagas.

Near Becej a blowout of carbon dioxide gas, on November 11, 1968, destroyed parts of the drilling rig and created mine sizable craters. At yearend the well was still blowing.

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The Mineral Industry of Zambia

By E. Shekarchi [1]

In general, the mineral industry of Zambia advanced to a new high record production in 1968. The copper industry, mainstay of the country's economy, set a new record in production and contributed 44 percent to Zambia's net domestic product. The copper industry not only was the main provider of government revenue, but also was important to world production since, after the United States and the Soviet Union, Zambia ranks as the third largest producer.

The impact of high copper earnings manifested itself throughout Zambia's cash economy. Although the rise in real per capita income in 1967 was estimated at 8 percent, total wage and salary payments rose 26 percent and average earnings of African industrial employees increased 39 percent.[2]

To insure the country's economic growth and to improve its balance of payments position, sweeping reforms were announced by the Zambian President in April 1968. They included: (1) Acquisition by the Government-owned Industrial Development Corporation (INDECO) of a 51-percent interest in 25 companies involved in building materials, transport, timber, and other industries; (2) limitation on remission of dividends by foreign companies, including the two large mining groups, to the lesser of 30 percent of equity capital or 50 percent of profits; (3) limitations on granting of trading licenses to non-Zambians; and (4) restrictions on local borrowing by expatriates.

The Government continued to devote a large share of its capital resources to overcoming Zambia's serious transportation deficiencies, many of which stem from Southern Rhodesia's Unilateral Declaration of Independence in 1965. In September 1968, the 1,058-mile petroleum products pipeline from Dar es Salaam was opened, putting an end to gasoline rationing and greatly reducing the expensive necessity of transporting petroleum products by road from that city. The Great North Road to the Tanzanian border will be completely paved except for the Luangwa-Nyimba section, for which entire engineering costs will be financed by the World Bank. Work was underway on the road extending from Lusaka to Mongu, capital of Baratas province. Mainland China will finance the engineering and provide technical personnel for the Mumbwa-Mankoya portion. In 1969 the Chinese will complete survey work for the proposed Tanzania-Zambia railroad, a project to which the Zambians attach particular importance.

PRODUCTION

The value of overall mineral production of the country increased by about 12.5 percent in 1968 compared with that of 1967. While cobalt production registered a 17-percent reduction, coal output rose to a new peak with 180,451 metric tons more than in 1967. In 1968, the Anglo-American Corporation produced about 53 percent of Zambia's copper output, and the Roan Selection Trust Ltd. (RST) group, about 47 percent.

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[1] Foreign mineral specialist, Division of International Activities.

[2] Where necessary, values have been converted from the Zambian currency kwacha to U.S. dollars at the rate of K1.00=US$1.40.

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Table 1.—Zambia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Cadmium—kilograms	14,631	18,158	12,093	10,000	11,297
Cobalt:					
Metal	1,345	1,544	1,515	1,455	1,197
Other forms, cobalt content	63	--------	(1)	(1)	(1)
Copper:					
Concentrate, copper content	68	280	60	60	36
Blister	145,431	163,526	88,786	82,755	93,038
Electrolytic	496,884	521,175	586,474	616,844	572,063
Other	531	193	340	643	570
Gold [2]—troy ounces	5,033	5,196	• 5,000	• 5,000	NA
Lead, refined	13,161	21,345	18,760	19,101	21,893
Manganese ore	36,370	30,813	26,702	24,968	25,373
Selenium [3]—kilograms	55,200	26,115	• 26,000	• 26,000	• 26,000
Silver [4]—troy ounces	1,445,934	848,819	• 750,000	• 750,000	• 768,000
Tin concentrate, tin content—long tons	8	16	3	NA	--------
Zinc, electrolytic	46,712	47,436	42,300	44,484	53,138
NONMETALS					
Amethyst—kilograms	6,714	21,254	36,100	39,839	17,270
Cement—thousand tons	151	221	256	300	280
Gypsum	--------	--------	1,075	1,418	1,075
Lime	NA	76,732	NA	70,000	71,549
Limestone	567,146	579,400	570,254	578,206	644,833
Phyllite	11,268	19,281	21,530	25,461	32,890
MINERAL FUELS AND RELATED MATERIALS					
Coal	--------	--------	114,127	393,067	573,518

• Estimate. NA Not available.
[1] Less than ½ unit.
[2] Chiefly contained in electrolytic copper refinery muds and blister copper.
[3] Contained in electrolytic copper refinery muds and blister copper.
[4] Refined silver and silver contained in electrolytic copper refinery muds and blister copper.

TRADE

In 1967, the total value of mineral commodity exports from Zambia was about $631 million, about 96 percent of total commodity exports. Copper remained the leading mineral as an exchange earner. The United Kingdom maintained its position as the principal trading partner of Zambia, followed by West Germany and Italy.

The value of total imports in 1967 was $428.8 million; mineral commodities accounted for about $50.4 million, about 35 percent more than in 1966. The completion of the petroleum product pipeline from Dar es Salaam to the copper belt, along with the indigenous production of coal in the Zambezi valley, brought some relief to the energy picture in Zambia in 1967. However, because of lack of petroleum resources in the country, Zambia depends on imports of this fuel and lubricants.

The value of mineral trade and total trade for recent years was as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1966	671.6	690.8
1967	681.0	658.0
Imports:		
1966	37.4	388.0
1967	50.4	428.8

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Table 2.—Zambia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Cadmium, metal	9	11	All to Republic of South Africa.
Cobalt, metal	1,627	2,091	All to United Kingdom.
Copper:			
Slimes	r 523	959	Sweden 523; Japan 284; West Germany 151.
Metal, unwrought:			
Blister	85,658	78,806	Japan 44,969; West Germany 24,849.
Electrolytic:			
Wire bar	422,994	450,813	United Kingdom 144,814; Japan 62,588; Italy 53,902.
Cathode form	89,980	69,044	Japan 23,000; United Kingdom 21,878.
Ingot and bar	537	797	All to West Germany.
Sheet, plain	-------	85	Do.
Iron and steel:			
Scrap	NA	NA	
Semimanufactures:			
Castings	28	-------	
Pipes and tubes	5	-------	
Lead:			
Bar and ingot	24,654	17,416	Republic of South Africa 6,307; Italy 3,542; Netherlands 1,626.
Sheet and bar	33	-------	
Manganese, ore and concentrate	26,107	24,715	Republic of South Africa 7,951; Netherlands 5,361; Southern Rhodesia 3,428.
Silver, unworked troy ounces	40,000	166,000	Republic of South Africa 86,000; West Germany 80,000.
Zinc, ingots and bars	41,557	39,811	Republic of South Africa 23,828; United States 3,501.
Old and scrap metal, not further identified.	918	813	Republic of South Africa 554; Southern Rhodesia 149.
NONMETALS			
Cement for building, including hydraulic lime.	136	40	Congo (Kinshasa) 33.
Lime	145	-------	
Marble, granite, and other stone	NA	NA	
Sand, stone, and gravel	2	-------	

r Revised. NA Not available.

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Table 3.—Zambia: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Aluminum semimanufactures		361	374
Chromium ore and concentrate		522	862
Copper and copper alloys, all forms		604	476
Iron and steel:			
Iron ore and concentrate		64	36
Scrap		635	52
Pig iron, sponge iron, and ferroalloys		5,617	2,837
Ingots and other primary forms		125	97
Semimanufactures		91,754	97,546
Lead and lead alloys		74	68
Tin and tin alloys	long tons	53	1,452
Nonferrous ores and concentrates, not further described		-------	105
Nonferrous metal scrap		20	2
Other old and scrap metal		14	84
NONMETALS			
Abrasives:			
Grinding and polishing wheels		116	107
Industrial diamond	carats	17,505	11,750
Other, crude		2	2
Asbestos, crude, washed or ground		1,124	771
Cement:			
Building, including hydraulic lime		96,641	87,782
Clinker		59,641	50,642
Fire and furnace (including furnace mortar)		1,040	729
Clays:			
Fire clay		1,540	676
Cornish stone, kaolin, and china clay		1,411	888
Fertilizers		48,559	69,972
Gypsum and plaster of paris		16,301	2,916
Lime, building		1,456	282
Marble, granite and other monumental stone		192	106
Mica, blocks or sheets		6	---------
Salt		12,365	11,797
Sulfur, crude		3,070	2,882
MINERAL FUELS AND RELATED MATERIALS			
Coal and coal products:			
Coal and briquets		906,495	983,001
Coke		70,961	74,267
Pitch, tar and other coal products		145	125
Petroleum refinery products:			
Gasoline	thousand 42-gallon barrels	623	803
Kerosine	do	33	110
Jet fuel	do	98	110
Distillate fuel oil	do	582	1,039
Residual fuel oil	do	29	302
Lubricating oils	do	72	84
Greases, jelly, and waxes		2,824	3,874
Asphalt and bitumen		r 19,755	20,706
Other	42-gallon barrels	4,341	3,014

r Revised.

COMMODITY REVIEW

METALS

Cobalt.—Zambia's cobalt production decreased from 1,455 metric tons in 1967 to 1,197 tons in 1968, a low for the last 5 years. Apparently the decrease was due to the closing of Rhokana's cobalt plant for 2 months to complete a major rehabilitation, and to the depressed market for cobalt in general. The overall sale value of cobalt reportedly was about $3.8 million in 1968.

Copper.—The high copper price and high rate of production in 1968 meant surprisingly good profits for the producers, Anglo-American group and the RST group. While the copper industry still faced many problems, few people would have predicted 3 years ago that it would be doing as well as it is. The prolonged U.S. copper strike of 1967 and 1968 boosted the price of copper on the London Metal Exchange (LME) and the producers took advantage of it.

As a result of the apparent stability of the Zambian copper industry, the RST group initiated in December 1967 for the

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first time a quarterly dividend system rather than continuing on the interim final dividend payment system. Also in the first week of June 1968, both major groups in Zambia announced that in the future, they will base their consumer price for copper wire bars on the cash price rather than the 3-month-forward LME price.

Considerable development in the overall copper industry was apparent over the last year. Four new mines, mostly open-pit, were being exploited by the Anglo-American group (River Lode, Mimbula—Nos. 1 and 2, and Fitula) and a big extension program was underway on the Nchanga mine. To cope with the additional ore, extra handling facilities, including a new East Mill, were to be provided.

An agreement was signed between two Japanese firms and the Zambian Anglo-American group in 1968. Terms of the agreement call for the Japanese firms to loan $42 million to the Anglo-American group, between June 1968 and April 1969, in exchange for 100,000 tons of copper over the next 10 years from the mines.

The RST group concentrated most of their efforts in 1968 on the Kalengwa and Babuba projects. Operations of these mines were expected to begin in the latter part of the year with initial production slated at 13,000 tons of copper. Also the full potential of Babuba was to be ascertained. Production capacity of Mufulira mine was also to be increased by about 25,000 tons of copper to a total of 187,000 tons.

The major purchasers of Zambian copper in 1966–68 were as follows:

Table 4.—Sales of Zambian copper to customer countries

(Thousand metric tons)

Country	1966	1967	1968
France	56	56	62
Germany, West	102	87	93
Italy	61	58	72
Japan	107	146	159
Spain	5	8	7
South Africa, Republic of	30	24	6
Sweden	15	18	20
Switzerland	10	11	10
U.S.S.R.	5	----	----
United Kingdom	234	202	223
United States	5	20	10
Other countries	46	46	57
Total	676	676	719

The expansion of Mufulira smelter to 50,000 tons per year was announced in 1968 after a thorough study. Apparently the RST group found expansion necessary to match increased production schedules foreseen in the 1970's. At a cost of about $8.2 million, the Mufulira project will be equipped with a 30-megavolt-ampere electric smelting furnace, ancillary equipment, and additional converters, and is expected to be completed within 2 years.

The Government and the copper companies have finally succeeded in rationalizing copper export routing. In 1968, virtually all of Zambia's copper production was carried by Rhodesia railways to Beira, the Great North Road to Dar es Salaam, and the Benguela Railway to Lobito. Shipments via four circuitous and costly surface routes have also been eliminated, and air cargo, which was used to transport copper to Dar es Salaam, was to cease by March 1969.

Bwana M'Kudwa, the copper mine near Ndola which is being reopened after being closed for 38 years, is expected to begin production early in 1971. When in full operation, output from the mine, owned by the Rhokana Corporation, will be on the order of 15,000 tons per year. Ore will be removed by open-pit methods with the pit eventually measuring 3,000 feet in length and 1,000 feet in width. Open-pit ore reserves are estimated at 5.76 million tons, averaging 3.84 percent copper. More than $14 million is to be spent on developing the mine, which is expected to have an 8-year lifespan.

It was reported that work has begun on clearing a site at Luanshya for the $3.5 million wire fabrication plant. Production is expected to begin in 1970 and the annual capacity of the plant is said to be 3,000 tons of copper wire and about 1,000 tons of aluminum wire and cable.

An agreement was signed in Lusaka in May 1968 between the Zambian Government and an international consortium for the establishment of a $4.2 million copper fabrication plant. The Government's industrial and Development Corporation (INDECO) will own 51 percent of the shares of the project and 49 percent will be owned by the international consortium—possibly Phelps-Dodge Corp. with its Swedish partner Svenska Metallverken, RST, Anglo-American Corporation and Continental Ore.

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Lead and Zinc.—Zambian Anglo-American Ltd. produced a record quantity of lead and zinc in 1968. The increase was mainly attributed to improved performance of the Imperial Smelting Furnace on which certain technical modifications were made. Apparently these modifications made it possible to handle high-grade materials which had not previously been amenable to treatment and which had been stockpiled. It was predicted that as long as the high-grade stockpiled ore lasts, production should remain at 1968 levels or perhaps higher. However, exhaustion of the high-grade lead-zinc ore will bring production back to the mid-1960 level.

The Government of Zambia, aware of the company's financial difficulties in 1967, agreed in 1968 to remit royalties over the period 1968–71 to the extent of losses incurred and to lend back to the company for 3 years, at an interest rate of 3 percent per year, any royalties payable after this remission. During the year, the Zambian Government refunded $628,600, representing a remission of royalties equal to the net loss for the year 1967.

Establishment of electrolytic zinc production facilities in South Africa in the latter part of 1968 produced a stiff and competitive marketing problem to Zambian Anglo-American Corporation since most of the company's zinc output was marketed in South Africa. However, the company was energetically looking for new markets to dispose of future production. Proven reserves at the end of 1968 were about 1.3 million tons with an average grade of 27.3 percent zinc and 13 percent lead, whereas the indicated reserve was given at approximately 4.4 million tons with an average grade of 25.6 percent zinc and 11.6 percent lead.

NONMETALS

Cement.—Satisfactory progress was made on the $17 million cement factory at Nodola owned jointly by the Zambian Anglo-American group and INDECO. In early 1968, clinker was produced and cement was expected to be produced by the end of the year. Once the plant is in full operation, according to reports, Zambian domestic production will increase 66 percent and imports of cement will be no longer necessary. The plant was designed for progressive expansion from the present level of 200,000 tons per year to 800,000 tons per year.

Lime.—The Zambian Anglo-American group holds a 50-percent interest in the Ndola lime operation. Inadequate rail transport capacity affected sales somewhat during the latter half of the year. However, the situation was improved when the principal consumers, the Zambian copper mining companies, arranged for other transportation of their lime requirements. Production of burnt lump lime was 59,000 tons, representing an increase of 7,500 tons over the 1967 figure.

Talc.—The Geological Survey of Zambia has outlined at Lilayi, 10 miles south of Lusaka, 300,000 short tons of talc reserves, of which about 100,000 tons are of high-grade steatite block. Also at Chipata, 16 miles east of Lusaka, about 1 million tons of mixed talc and pyrophyllite reserves have been proven. Apparently talc mining in Zambia is being undertaken by the Government's INDECO through its subsidiary, Crushed Stone Sales Limited. During the year, Zambia was seeking markets in Europe, America, and Japan for the talc; however, no production level was given.

MINERAL FUELS

Coal.—The new coal industry of Zambia took huge strides in 1968, both by proving reserves of various coal deposits and by producing coal. The coalfields of Zambia, about 15 to 20 miles west of Lake Kariba, run parallel to the shoreline, and seem to be an extension of the coalfields in Southern Rhodesia. Three coalfields have been identified—namely, Siankondobo or Maamba, Nkandabwe, and Mulungwa.

The Nkandabwe Coal Company was set up in 1966 with 50-percent government participation and 50 percent held jointly by the two copper mining groups, RST and the Anglo-American Corporation, who use substantial amounts of coal in treating copper ore. The first-stage output from Nkandabwe was set for 300,000 short tons per year. However, by the end of 1968, due to improvements in the facilities, production was reported at 5,000 tons per day. The proven reserve in situ was given by the Zambian Geological Survey at about 8 million tons with about 25 percent ash content. The company was installing a washing plant to reduce the ash content.

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In mid-1968, production efforts were focused on the more productive area of Maamba. It was undoubtedly the intention of the recently created National Coal Board of Zambia (NCBZ) to push ahead with development of Maamba. An agreement was signed between the Société Francaise d'Études Minieres (Soframines) and the Zambian Government under which Soframines is to act as technical advisors and consultants for the entire coal mining project and for training Zambian personnel. Maamba coal reserves were given by the Zambian Geological Survey at about 92 million tons, about one-third of which could be worked by open-cast methods and the remainder by underground methods. Ash content varies from 16 to 21 percent. However, a coal washery with an annual capacity of 1 million tons, now under construction at Batoka village, will reduce the ash content to 11 to 13 percent. Mulungwa coalfield is the most southerly extension of the coalfields discovered. Proven reserves of 25 million tons of coal, with an ash content of about 25.9 percent, was reported by the Zambian Geological Survey.

Although Zambia may be able to rely on getting most of its coal requirements from Maamba, some Wankie coal will have to be imported from Rhodesia to mix with coal for copper smelting purposes.

Petroleum.—In September 1968, the 1,058-mile petroleum products pipeline from Dar es Salaam was opened, putting an end to gasoline rationing and greatly reducing the expensive necessity of transporting petroleum products by road from Dar es Salaam to the copper belt. The pipeline was built at a cost of approximately $44 million by SNAM Progetti, a subsidiary of the Italian Ente Nazionale Idrocarburi (ENI). At full-capacity operation, the pipeline will deliver about 4,000 barrels per day.

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The Mineral Industry of the Islands of the Caribbean

By Burton E. Ashley[1]

CONTENTS

	Page		Page
Bahamas	823	Haiti	831
Barbados	824	Jamaica	831
Bermuda	826	Martinique	835
Cuba	826	Netherlands Antilles	836
Dominican Republic	828	Trinidad and Tobago	839
Guadeloupe	830		

BAHAMAS

Mineral production of the Bahamas in 1967 was not of great importance to the general economy, but established and planned projects will add more value in the ensuing years.

Reported mineral output in 1967 amounted to slightly more than 4 million tons of cement and 1 million tons of solar salt. Cement was produced by the Bahama Cement Co., a wholly owned subsidiary of the United States Steel Corp.

Trade in mineral commodities was chiefly in imports of iron and steel items and petroleum refinery products. Except for scrap metal, exports were limited to nonmetals.

The United States supplied 69 percent of total imports while receiving 71 percent of the exports.

Diamond Crystal Salt Co. began its first commercial salt harvest from its solar evaporation facility on Long Island in August 1968.[2] Plans called for an annual salt output of up to 500,000 tons per year within 4 years of beginning operations. Salt will be marketed to industrial users and for ice and snow control, presumably on the east coast of the United States.

Morton International Ltd. produced solar salt on Great Inagua Island. Deep water loading facilities were being improved to provide for a loading rate of over 650 tons per hour.

Aqua-Chem, Inc. was awarded a contract by the Bahamas Oil Refining Co. to erect a saline water desalting plant at Freeport. The plant was designed for a capacity of 1.3 million gallons daily and was expected to go into service in 1969.

Bahamas Oil Refining Co., jointly held by New England Petroleum Corp. (65 percent) and Standard Oil Co. of California (35 percent), planned to build a refinery at Freeport capable of processing 200,000 barrels of crude oil daily.

In addition to low-sulfur fuel oil for export to the U.S. east coast, the refinery will make petrochemical feedstocks, jet fuels, and home heating oil.

A construction contract for the $60 million plant was awarded to the Italian firm, SNAM Progetti. It was expected that refinery feed would be supplied from fields in Libya, Cabinda, and Venezuela. Offshore docking facilities to accommodate tankers of over 300,000 tons were planned.

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[1] Physical scientist, Division of International Activities.

[2] American Metal Market. V. 75, No. 182, Sept. 20, 1968, p. 13.

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Compagnie Francaise des Pétroles and Société Nationale des Pétroles d'Aquitaine made an agreement for each to earn a 25-percent interest in offshore leases held by Gulf Oil Corp. and Standard Oil Co. of California. The permit area consists of 4,550 square miles lying some 150 miles south of Nassau. The two French companies will do additional seismic work and drill a 14,700-foot-deep wildcat test at their expense in order to earn their interest in the lease.

Table 1.—Bahamas: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967
METALS	
Scrap, unspecified, value US$	40,050
NONMETALS	
Cement	421,693
Salt	650,408
Stone, sand and gravel:	
Limestone, value US$	37,240
Sand	147,500

Source: Bahamas Trade Return of H. M. Customs, 1967.

Table 2.—Bahamas: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967
METALS	
Iron and steel, semimanufacturers, value, million US$	6.2
Nickel, metal, including alloys, value US$	57,890
Silver, metal, including alloys, do	20,066
NONMETALS	
Cement	31,944
Fertilizers	4,021
MINERAL FUELS AND RELATED MATERIALS	
Coal	3
Petroleum: Refinery products:	
Gasoline, thousand 42-gallon barrels	529
Kerosine, do	145
Residual fuel oil, do	954
Lubricants, do	49
Other, do	2

Source: Bahamas Trade Return of H. M. Customs, 1967.

BARBADOS

The mineral industry of Barbados was of slight consequence to the domestic economy. Some burned lime was exported, but no other mineral output was recorded for 1968, with the exception of crude oil, gas, and refinery products. Crushed limestone and other rock is produced from time to time, but figures are not always available. Crude oil production in 1968 was reported at 278 barrels and natural gas at 96.7 million cubic feet.

Mobil Oil Barbados, Ltd., operated the only domestic refinery, and production figures for recent years are shown in table 3.

Table 3.—Barbados: Petroleum refinery production

(Thousand 42-gallon barrels)

Product	1964	1965	1966	1967	1968 p
Gasoline	27	61	103	NA	226
Kerosine	24	29	77	NA	101
Distillate fuel oil	59	91	182	NA	234
Residual fuel oil	100	120	136	NA	149
Asphalt	18	28	NA	NA	36
Other	6	NA	25	NA	NA

p Preliminary. NA Not available.

The United Kingdom supplied 29 percent of total commodity imports by value in 1967, followed by the United States with 18 percent; other Commonwealth countries supplied 28 percent of the total. All crude oil imports came from Venezuela.

Of total commodity exports by value, 41 percent went to the United Kingdom, followed by the United States with 15 percent; other Commonwealth countries received 23 percent of the total exports.

General Crude Oil Co., a subsidiary of Sun Oil Co., carried on an offshore geophysical survey around Barbados. General Crude held exclusive oil exploration rights in Barbados and its territorial waters. The company reportedly was to import a rig capable of drilling to 12,000 feet.

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Table 4.—Barbados: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	4	(1)
Copper, metal, including alloys, all forms	6	6
Iron and steel: Metal:		
Scrap	914	22
Semimanufactures	1,100	868
Lead, metal, including alloys, all forms	58	20
Tin, metal, including alloys, all forms—long tons	------	28
Zinc, metal, including alloys, all forms	------	2
Other, ash and residue containing nonferrous metals	138	10,881
NONMETALS		
Cement	------	1
Clays and clay products (including all refractory brick)	------	172
Diamond, gem, not set—carats	------	2,645
Diatomite, and other infusorial earths	------	4
Fertilizer materials	39	(1)
Salt	4	3
Sodium and potassium compounds, n.e.s	------	13
Stone, sand and gravel:		
Dimension stone	NA	1
Gravel and crushed rock	7,974	13,866
Other crude nonmetals	636	751
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, excluding briquets	NA	19
Gas, hydrocarbon, manufactured	NA	16
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	20	511
Kerosine—do	263	112
Distillate fuel oil—do	880	558
Residual fuel oil—do	1,522	1,123
Lubricants—do	2	1
Mineral jelly and waxes thousand 42-gallon barrels	(1)	(1)
Other—do	6	(1)

NA Not available.
[1] Less than ½ unit.

Source: Government of Barbados. Statistical Service. Overseas Trade. 1966, 344 pp.; 1967, 346 pp.

Table 5.—Barbados: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	181	119
Copper, metal, including alloys, all forms	5,921	43
Iron and steel: Metal:		
Scrap	49	------
Pig iron, ferroalloys and similar materials	4	16
Steel, primary forms	197	103
Semimanufactures	9,126	7,923
Castings and forgings	------	25
Lead, metal, including alloys, all forms	124	153
Tin, metal, including alloys, all forms—long tons	304	457
Zinc, metal, including alloys, all forms	3	27
Other:		
Ore and concentrate	------	15
Oxides, hydroxides and peroxides of metal, n.e.s	------	195
NONMETALS		
Abrasives, natural, n.e.s	13	5
Asbestos	1,110	385
Cement	33,568	34,281
Chalk	------	36
Clays and clay products (including all refractory brick)	54,582	626
Fertilizer materials:		
Crude	72	1
Manufactured	16,187	19,532
Lime	508	105
Mica, all forms	NA	2
Salt	2,134	2,127
Sodium and potassium compounds	------	196
Stone, sand and gravel:		
Dimension stone	268	49
Gravel and crushed rock	NA	233
Sand	27	14
Sulfur, elemental	------	25
Other nonmetals, n.e.s	------	54
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	NA	61
Carbon black	NA	1
Coal, all grades, including briquets	554	597
Coke	NA	52
Gas, hydrocarbon, manufactured	NA	1,556
Petroleum:		
Crude thousand 42-gallon barrels	689	704
Refinery products:		
Gasoline—do	179	24
Kerosine and jet fuel thousand 42-gallon barrels	149	113
Distillate fuel oil—do	812	551
Residual fuel oil—do	1,438	1,046
Lubricants—do	10	11
Mineral jelly and wax thousand 42-gallon barrels	1	1
Other—do	5	5
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals—do	NA	14

NA Not available.

Source: Government of Barbados. Statistical Service. Overseas Trade. 1966, 344 pp.; 1967, 346 pp.

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BERMUDA

Bermuda's small mining industry was limited to output of sand and limestone. The only production reported in 1968 comprised 95,000 tons of crushed stone which was used by the producers in construction work.

Imports consisted chiefly of petroleum products and metal and nonmetallic items for construction. Chief imports for 1967 are listed in the following tabulation:

Cement, portland	metric tons	22,796
Cement, other	do	1,600
Refinery products:		
Asphalt	thousand 42-gallon barrels	14
Lubricating oil	do	7
Gasoline	do	241
Jet fuel	do	189
Liquid petroleum	do	28
Distillate fuel oil	do	820
Residual fuel oil	do	34

Mineral commodity exports in 1967 were limited to scrap metal and petroleum products. Destination of the refinery products was listed as to bunkers and commercial.

In terms of value, the United States provided 49 percent of Bermuda's total commodity imports. It is of interest to note that despite Bermuda's rather limited foreign trade requirements, over 70 countries consigned goods to that colony in 1967.

Table 6.—Bermuda: Estimated production of mineral commodities

(Metric tons)

Commodity	1964	1965	1966	1967	1968 p
Lime	100	100	20	10	NA
Stone, sand and gravel, n.e.s.:					
Dimension stone: Limestone	27,433	29,465	30,482	22,861	NA
Crushed and broken	r 72,043	49,786	71,123	84,382	95,000
Sand (crushed and natural)	r 37,112	71,124	77,220	105,559	NA

r Revised.
NA Not available.

Table 7.—Bermuda: Exports and reexports of mineral commodities

Commodity		1966	1967
METALS			
Scrap, unspecified	value	$90,641	$73,714
MINERAL FUELS AND RELATED MATERIALS			
Petroleum: Refinery products:			
Gasoline:			
Aviation	thousand 42-gallon barrels	65	48
Other	do	22	23
Kerosine	do	2	1
Jet fuel	do	588	560
Residual fuel oil	do	209	139
Lubricating oil	do	4	53

CUBA

With the exception of foreign trade statistics for selected countries, no information of great reliability has come to the attention of the Bureau of Mines regarding the mineral industry of Cuba for this year.

In addition to its general economic problems, lack of petroleum products appears to be an important factor in braking industrial progress. The René Arcay cement plant is reportedly using nearby occurring

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asphalt as a portion of its fuel in order to save fuel oil.[3]

Electrical energy is saved by doing routine maintenance on some industrial plants during evening hours when the heavier load is on the national power network.

Firm mineral production figures have not been available for a number of years, but the Bureau of Mines estimates nickel and cobalt output for 1968 at about 27,200 and 1,100 tons, respectively.

In addition to trade with the U.S.S.R. as shown in table 8, trade with Poland for 1966–67 is shown in the following tabulation:

Commodity	1966	1967
EXPORTS		
Chromite	r 22,702	24,905
Copper, ore and concentrate	3,518	2,520
Manganese, ore and concentrate	r 26,195	37,989
Other nonferrous concentrate	290	337
IMPORTS		
Steel sheets	275	490
Cement	10,000	19,730
Coke	8,000	8,000
Petroleum refinery products	397	1,331

r Revised.

In 1967, Yugoslavia supplied Cuba with the following mineral-based commodities, in metric tons: Coated wire, 94; barbed wire, 1,346; aluminum sheets, 471; aluminum foil, 1.5; and distillate and light fuel oil, 294.

In 1968, selected mineral trade with France consisted of the following exports to France, in metric tons: Nickel, 4,481 and mineral raw materials, 575. Chief mineral exports to Cuba were manufactured fertilizer, 163,983 tons; iron and steel, 2,155 tons; mineral fuels, 17 tons; and raw mineral products, 139 tons.

A copper deposit was reportedly discovered[4] in the extreme western part of Pinar del Rio which was expected to rival Matahambre for at least 30 years.

A kaolin-processing plant on the Isle of Pines was being reequipped in order to increase production to 20,000 tons per year from the present output of 16,260 tons.

Since 1959, 49 large and small dams have been completed or are under construction. Five of the dams are on the Isle of Pines.

[3] World Mining. V. 5, No. 2, February 1969, pp. 30–32.

[4] Engineering and Mining Journal. V. 169, No. 11, November 1968, p. 114.

Table 8.—Cuba: Selected mineral commodity imports from U.S.S.R.

(Metric tons)

Commodity	1966		1967	
	Quantity	Value (thousand rubles)	Quantity	Value (thousand rubles)
METALS				
Aluminum, metal, including alloys, all forms	4,100	2,841	4,900	3,430
Copper, metal, including alloys, all forms	r 4,500	4,776	4,500	4,828
Iron and steel: Metal:				
Pig iron	42,200	1,538	60,200	1,946
Ferroalloys	1,400	131	1,300	159
Steel semimanufactures:				
Tinned plates and sheets	26,900	5,595	24,800	5,183
Tubes and pipe	24,100	3,826	28,000	4,139
Other rolled products	142,900	15,115	126,500	12,979
Lead, metal, including alloys, all forms	r 1,000	324	900	231
Zinc, metal, including alloys, all forms	500	158	600	173
NONMETALS				
Asbestos	6,000	741	9,900	1,380
Cement	162,000	1,630	257,000	2,377
Fertilizer materials:				
Nitrogenous	r 278,000	r 12,587	416,800	19,461
Phosphatic	105,600	2,007	115,800	2,275
Potassic	101,400	2,301	91,700	1,957
Refractory materials	5,000	373	12,400	945
Sulfur	76,800	2,786	135,500	6,588
MINERAL FUELS AND RELATED MATERIALS				
Carbon black	r 2,200	r 345	3,800	575
Coke—thousand tons	26	529	39	776
Petroleum:				
Crude—do	3,840	39,729	3,838	39,759
Refinery products:				
Gasoline—do	100	2,610	104	2,624
Distillate fuel oil—do	247	4,167	321	5,261
Residual fuel oil—do	826	7,535	955	8,720
Lubricants, including greases—do	75	5,436	68	5,019
Mineral jelly and wax	1,900	256	1,300	175

r Revised.

Source: Vneshnyaya Torgovlya S.S.S.R. za 1967 god (Foreign Trade of the U.S.S.R. for 1967).

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DOMINICAN REPUBLIC

The mineral industry of the Dominican Republic was of little importance to the domestic economy, with production largely limited to bauxite and cement. Some nickel and copper were produced on an experimental basis, and salt was probably produced on a continuing basis but figures were not available.

While the mineral industry played but a small part in the economy, it is expected that large investments will be made in the next few years. Areas of interest to investors were nickel, copper, iron ore, and petroleum refining.

The Government continued to be receptive to foreign investment, particularly in cases where financing was to be obtained from abroad and the new ventures would not compete excessively with established businesses.

The continued strong activity in building, plus proposed irrigation projects, was expected to increase demand for cement and common construction materials.

The few mineral commodities exported were overshadowed in importance by bauxite. Bauxite exports in 1967, all to the United States, were valued at $12.8 million and amounted to 8.2 percent of total commodity exports and 96 percent of all mineral exports.

Imports, by value, were led by petroleum refinery products, followed by iron and steel items and other metals and nonmetals.

The United States was the Dominican Republic's predominant trading partner during 1967, having supplied 52 percent of total commodity imports, while receiving 52 percent of the exports, on a value basis.

The following tabulation compares value of mineral trade with that of total commodity trade during the years 1965–67:

	Value (million dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	11.8	125.5
1966	10.3	136.7
1967	13.4	156.2
Imports:		
1965	14.9	86.7
1966	19.6	160.8
1967	23.0	174.7

[1] RD$1 = US$1.

Source: República Dominicana. Secretariado Tecnico de la Presidéncia. Oficina Nacional de Estadística. Comercio Exterior de la República Dominicana. V. 15, 1967. Santo Domingo, D.N., 1968, 303 pp.

Metals.—*Bauxite and Alumina.*—Bellomar Inc., a joint exploration company, was formed by Campbell Chibougamau Mines Ltd., Bayou Interests, Inc., and Phelan Sulphur Co. to appraise two bauxite concessions and one of iron ore. The largest bauxite concession contains over 750,000 acres in the Barahona Peninsula; the other one contains about 325,000 acres in the Rio San Juan area.

Table 9.—Dominican Republic: Production of mineral commodities

(Metric tons)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum, bauxite, dry equivalent	760,290	941,756	833,008	983,043	994,338
Copper, mine output, metal content	---	---	---	33	105
Nickel, ferronickel, nickel content	---	---	---	34	294
NONMETALS					
Cement, hydraulic	297,515	211,974	276,398	310,120	327,851
Gypsum	109,694	89,499	90,883	118,710	NA
Salt:					
Rock, thousand tons	2	21	• 20	(1)	NA
Marine (including other evaporated), thousand tons	29	26	• 25	NA	NA
Stone, sand and gravel [2], crushed and broken: Limestone	398,470	271,667	359,317	NA	12,342

• Estimate. NA Not available. p Preliminary.
[1] Less than ½ unit.
[2] Granite, glass sand, common sand, marble, and travertine are produced in the Dominican Republic from time to time, but statistics are not regularly reported.

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Table 10.—Dominican Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, bauxite	1,001,280	1,243,342
Iron and steel, scrap	749	410
NONMETALS		
Amber—kilograms	--	357
Cement	15,995	10,142
Clays and clay products (including all refractory brick)	196	226
Gypsum and plasters	73,350	85,431
Lime	--	139
Salt	100	200
Stone, sand and gravel, dimension stone	106	--
MINERAL FUELS AND RELATED MATERIALS		
Coal	3	--
Petroleum refinery products, lubricants	6	(1)

[1] Less than ½ unit.

Source: República Dominicana, Oficina Nacional de Estadística. Comercio Exterior, V. 15, 1967. Santo Domingo, 1968, 303 pp.

Table 11.—Dominican Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Copper, metal, including alloys, semimanufactures	717	832
Gold, silver, platinum, metal, unworked or partly worked troy ounces	21,316	191,072
Iron and steel, semimanufactures	39,416	50,960
Other metals, including alloys, all forms	1,602	1,440
NONMETALS		
Cement	3,536	3,805
Stone, sand and gravel	1,528	2,602
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	990	321
Petroleum: Refinery products:		
Gasoline thousand 42-gallon barrels	1,442	1,517
Kerosine—do—	222	267
Distillate fuel oil—do—	616	755
Residual fuel oil—do—	r 1,366	1,469
Lubricants—do—	63	44
Other—do—	96	203

r Revised.

Source: República Dominicana, Oficina Nacional de Estadística, Comercio Exterior de la República Dominicana 1967. V. 15, 303 pp. Santo Domingo, 1968.

In addition, a feasibility study was in progress on a 40,000-acre concession in the Hatillo iron ore area.

The Government announced at yearend that it would call for international bids for the construction of an alumina plant. Under its contract with the Aluminum Company of America, which mines bauxite on the Barahona Peninsula, the Government is entitled to buy 850,000 tons of bauxite annually when it completes a processing plant.

Copper and Manganese.—The Special Commission which was organized to consider 16 applications from foreign and domestic firms to explore copper and manganese properties around Las Cañitas rejected all offers. According to the Commission, the requests "did not meet the national interest requirements." A date for submission of new applications had not been set by yearend.

Gold.—The Pueblo Viejo mine was leased to Minerales Industriales C. por A. after 12 months of negotiations. Exploration work to yearend 1968 reportedly resulted in outlining 64 million tons of gold, silver, and zinc ore valued at around $40 per ton. Recoverable sulfur was expected to cover all production costs. The mining plan called for an open-pit operation. Initial plant installation was planned to process 2,500 tons of ore daily.[5]

Iron and Steel.—Productos Diversos C. por A. was formed by three firms from the Dominican Republic and two from Japan for the purpose of manufacturing hot-dip galvanized iron sheet. The company was capitalized for $500,000 and expected to locate its plant near Santo Domingo. Eighty percent of the ownership interest will remain within the country.

It was expected that 12,000 tons of sheets would be produced initially, with output eventually rising to 25,000 tons. Raw materials, machinery, and technology were to be furnished by the Japanese partners.

Nickel.—Falconbridge Dominicana C. por A. continued operation of its ferronickel pilot plant until August 1968. Drilling activity continued for further defining of the orebody, and some structural foundation investigations were made for the proposed plant. Construction contracts were called to cover erection of the metallurgical plant, service facilities, and the main components of the powerplant. Total cost to bring the projects to the production stage was set at $180 million. Actual construction was expected to start in early 1969.

[5] Mining Journal (London). V. 271, No. 6951, Nov. 8, 1968, p. 365.

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Mineral Fuels.—*Petroleum.*—Gas y Petróleos Dominicanos reportedly resumed drilling operations on a well that was shut down in 1965. A second well was started in early 1968. Both tests are in the Azua area.

Midland Cooperatives, Inc., a U.S.-based firm, was building a 15,000-barrel-per-day refinery; completion date was set for early 1969.

Antilles Petroleum, held by Puerto Rican interests, was reported to have been seeking Government permission to build a 25,000-barrel-per-day refinery near Azua.

GUADELOUPE

Little information was available on the minerals industry of Guadeloupe, but the following tables on production and foreign trade give some gauge of those activities.

Of imports valued at $99.6 million in 1967, France supplied $71.3 million worth. Value of total commodity exports amounted to $32.4, of which $23.9 in value were consigned to France. The United States ranks as Guadeloupe's second most important trading partner.

Table 12.—Guadeloupe: Estimated production of mineral commodities

(Metric tons)

Commodity	1964	1965	1966	1967	1968 p
Clays	NA	NA	NA	34,000	NA
Tuff (pozzolanic)	NA	NA	NA	48,000	64,000
Stone, sand and gravel:					
Crushed and broken, n.e.s.[1] thousand tons	1,008	1,410	NA	1,962	1,983
Sand	NA	102,000	NA	158,000	187,000

p Preliminary. NA Not available.
[1] May include material of igneous and sedimentary origin, used for ballast, fill, and other purposes.

Table 13.—Guadeloupe: Exports of selected mineral commodities

(Metric tons unless otherwise stated)

Commodity	1966	1967
METALS		
Gold, metal, unworked or partly worked value	$1,000	------
Iron and steel: Metal:		
Scrap	------	900
Castings and forgings	9	67
Radioactive and associated materials	5	6
Nonferrous metal scrap	154	145
NONMETALS		
Cement and mineral manufactures, n.e.s	117	7
Clays and clay products (including all refractory brick)	7	4
Fertilizer materials, manufactured	5	------
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	243	40

Table 14.—Guadeloupe: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	151	172
Copper, metal, including alloys, all forms	56	51
Gold, metal, unworked or partly worked value	$38,000	$42,000
Iron and steel: Metal:		
Steel, semimanufactures	20,577	16,437
Castings and forgings	60	67
Lead, metal, including alloys, all forms	38	31
Silver, metal, including alloys value	$2,000	------
Tin, metal, including alloys, all forms long tons	4	3
Zinc, metal, including alloys, all forms	32	32
Other, scrap, nonferrous	------	6
NONMETALS		
Abrasives, natural, n.e.s	10	15
Cement and mineral manufactures, n.e.s	85,962	99,243
Clays and clay products (including all refractory brick)	3,513	2,236
Fertilizer materials:		
Crude	359	------
Manufactured	30,942	30,569
Stone, sand and gravel	184	155
Other nonmetals, n.e.s.:		
Crude	1,138	1,321
Manufactured	232	233
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	23	40
Gas, natural and manufactured	2,786	3,352
Petroleum refinery products	84,828	98,242
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	43	14

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HAITI

Reynolds Haitian Mines, S.A., with bauxite output approaching 500,000 tons annually, ranked as one of Haiti's largest industries.

The only other mining concern of consequence was Sedren, S.A., a wholly owned subsidiary of Consolidated Halliwell, Ltd., which produced copper concentrates, containing gold and silver values. Another subsidiary, Compagnie Nationale D' Exploration, S.A., was carrying out exploration on its concession in northern Haiti.

Local interests were developing a marble quarry but there was no evidence of production during 1968.

A new mining law was promulgated February 22, 1968.[6] Definitions were clarified as to mines and quarries, permits to prospect or mine, and taxes to be paid. The Geology and Mines Service was created by decree to help administer provisions of the mining law. The Service was made a part of the Secretariat of State of Agriculture, Natural Resources and Rural Development.

Table 15.—Haiti: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Aluminum, bauxite, dried	437,160	382,588	361,426	359,192	445,664
Copper, mine output, metal content	5,029	3,960	2,780	2,350	1,597
Gold, mine output, metal content, troy ounces	8,090	6,719	5,071	e 5,000	e 3,000
Silver, mine output, metal content, do	92,057	77,488	50,690	e 34,000	e 17,000
NONMETALS					
Cement, hydraulic, thousand tons	56	42	38	40	41

e Estimate. p Preliminary.
[1] Clay, gravel, limestone, marble, sand, salt, and possibly other minerals are also produced in Haiti; neither statistics nor reliable estimates are available for quantity of such output.

Table 16.—Haiti: Selected exports of mineral commodities

(Metric tons)

Commodity	1965	1966
METALS		
Aluminum, bauxite	427,799	332,782
Copper:		
Ore and concentrate	10,221	9,124
Metal, scrap	127	93
Iron and steel, scrap	211	------
NONMETALS		
Cement	81	------

Complete foreign trade statistics for 1966 were not available in time for publication. Mineral exports, chiefly bauxite and copper concentrates, went exclusively to the United States and Japan, respectively. Chief imports of mineral commodities were petroleum products, iron and steel semimanufactures (9,600 tons), and aluminum semimanufactures (185 tons).

Of total commodity trade, the United States received 45 percent of the exports and supplied 64 percent of the imports.

JAMAICA

The 1968 pace of the Jamaican economy quickened after easing during the previous year. According to Government reports,[7] the growth in the gross domestic product (GDP) increased at over 9 percent, or about double that of 1967.

Bauxite mining and alumina processing are of considerable importance to the Jamaican economy, and the investment of $450 million in completed alumina facilities, or those under construction, added an appreciable share of strength to the economy. Mining, quarrying, and refining contributed 9.8 percent of GDP in 1968; the share of the bauxite industry alone was probably between 8.5 and 9 percent.

[6] Martindale Hubbel Law Directory. Haiti Law Digest. V. 5, 1969, p. 3052.
[7] Government of Jamaica. Economic Survey, Jamaica. Prepared by the Central Planning Unit, Kingston, Jamaica, 1968, 125 pp.

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Earnings from 1968 bauxite exports increased 2.5 percent over the 1967 figure, while alumina export value gained 21.7 percent over the 1967 level. Currency devaluation in November 1967 affected the comparative changes; adjustments made for the effect of devaluation resulted in a 12-percent decrease in bauxite earnings and only a 4-percent gain in earnings from alumina.

According to Government figures, the total bauxite-alumina export earnings in 1967 were J£38.4 million ($107.6 million at J£1 = US$2.80) compared with 1968 figures of J£44.4 million ($106.7 million at J£ = $2.80).

Labor problems continued to hamper industry in general during 1968. A 6-week strike in mid-1968 at the construction site of Alumina Partners of Jamaica, Ltd. (ALPART), was not expected to delay the proposed completion date.

In 1967, the latest period for which figures are available, the bauxite-alumina industry employed 7,308 persons, including onsite construction workers. This was a 22-percent rise over employment in 1966.

Wages paid by the industry in 1967 amounted to $20.2 million compared with the 1966 wage bill of $15.5 million.

PRODUCTION

Bauxite mining and alumina processing were overwhelmingly the most important part of the Jamaican extractive mineral industry. Output of bauxite in 1968 registered a decline of 8 percent from the 1967 level, the first drop during the last 5 years. Expansion in alumina processing is indicated by the 10-percent rise in 1968 production over that in 1967.

Increasing construction activity accounted for appreciable rises in output of cement and common construction mineral commodities.

TRADE

Bauxite-alumina exports valued at $107.6 million in 1967 accounted for 89 percent of mineral exports, and 50 percent of total commodity exports.

Chief mineral import categories were of iron and steel items, fertilizers, and some petroleum refinery products.

The United States, United Kingdom, and Canada dominated Jamaican trade, accounting for 80 percent of exports, and 70 percent of imports by value. Nearly 40 percent of export value went to the United States, followed by United Kingdom and Canada with 26.4 percent and 13.7 percent, respectively. Of imports, United States supplied 38.7 percent, United Kingdom 19.9 percent, and Canada 11.2 percent.

All[8] recorded exports of bauxite in 1967

[8] Government of Jamaica, Department of Statistics, Trade Statistics Unit. External Trade of Jamaica, Calendar Year 1967. 1968, 319 pp.

Table 17.—Jamaica: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum:					
Bauxite, dry equivalent of crude ore [1]	7,936,468	r 8,651,021	r 9,061,518	r 9,267,692	8,525,488
Alumina (exports)	780,656	732,361	803,849	887,787	922,388
Iron and steel, semimanufactures	---	---	---	---	10,047
NONMETALS					
Cement, hydraulic	281,339	312,582	355,434	335,297	408,916
Clays	55,221	95,684	125,894	• 126,000	• 140,000
Gypsum	195,212	211,846	193,000	167,000	208,653
Stone, sand and gravel:					
Crushed and broken: Limestone	4,300,656	[2] 429,058	[2] 529,747	• r 480,000	• 1,816,582
Gravel	668,400	790,214	NA	• 422,500	• 465,309
Sand, excluding glass sand	273,000	310,428	NA	• 1,300,000	• 1,430,000
Sand (for glass)	10,474	7,301	8,636	• 8,700	• 8,900
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline----thousand 42-gallon barrels	1,033	1,614	2,008	1,542	1,017
Kerosine and jet fuel----do	528	993	1,113	819	971
Distillate fuel oil----do	1,208	1,777	1,905	4,647	1,692
Residual fuel oil----do	3,852	4,561	4,400		4,139
Liquefied petroleum gas----do	55	97	122	NA	113
Asphalt----do	24	54	129	NA	92
Other----do	NA	247	3	356	NA

• Estimate. p Preliminary. r Revised. NA Not available.
[1] May include bauxite used in cement manufacture.
[2] For cement manufacture only.

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went to the United States; the total of 7,257,057 metric tons was valued at $53.2 million. Total alumina exported was 837,198 metric tons valued at $58.5 million; principal destinations were as follows, by tonnage (and US$ values): Canada 391,012 ($27.3 million); Norway 270,022 ($18.9 million); United States 115,842 ($8.1 million); Sweden 50,593 ($3.5 million). The remainder went to Switzerland and Trinidad and Tobago.

The following tabulation shows the comparison of mineral trade with that of total commodity trade for 1965–67:

	Value (million dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	109.0	r 214.4
1966	117.3	r 228.0
1967	121.1	214.4
Imports:		
1965	61.3	289.1
1966	63.5	327.2
1967	56.6	353.6

r Revised.
[1] Where necessary, values have been converted at the rate of J£1 = US$2.80.

Source: Jamaica. Department of Statistics, Trade Statistics Unit. External Trade of Jamaica, Calendar Year 1967. 1968, 319 pp.

COMMODITY REVIEW

Metals.—*Aluminum.*—Alcoa Minerals of Jamaica, Inc., a subsidiary of Aluminum Company of America, reportedly commenced construction of its alumina plant at Woodside, Clarendon Parish. The 800,000-ton plant (initial capacity 400,000 tons annually) represents an investment of about $120 million. The plant was to be capable of processing low-grade ore containing more than 4 percent silica.[9]

Under the original construction agreement with Alcoa, the Jamaican Government has the right to transport up to one-half of the alumina output in its own ships for overseas destinations; that is, if Jamaican bottoms are available. This condition may provide the impetus for Jamaica to develop its own merchant marine.

Alcan Jamaica, Ltd.,[10] reportedly completed the expansion of its alumina capacity to around 1.2 million tons annually.

Alcan Products of Jamaica began operation of a 2,000-ton-per-year aluminum extrusion plant at yearend. Located in Spanish Town, the $960,000 plant is able to handle billets up to 6 incres in diameter.[11]

Copper.—The Jamaican Government reportedly approved agreement between Cominco, Ltd., and Burrex Mines, Ltd., to develop a 15-square-mile copper prospect.[12]

Table 18.—Jamaica: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite and concentrate	7,132,280	7,257,057
Oxide (alumina) and hydroxide	803,381	837,198
Metal, including alloys, all forms	37	133
Copper, metal, including alloys, wrought	10	(1)
Iron and steel:		
Scrap	150	1,262
Steel, primary forms	64	10
Semimanufactures	101	234
Lead, metal, including alloys, all forms	7	15
Zinc, metal, including alloys, all forms	6	12
Other, ash and residue containing nonferrous metals	1,886	590
NONMETALS		
Asbestos	185	474
Cement	135,054	77,238
Clays and clay products (including all refractory brick)	5	--------
Fertilizer materials, manufactured	7	8,394
Gypsum	r 200,943	191,724
Lime	11	10
Salt	23	17
Sodium compounds	3	6
Stone, sand and gravel:		
Dimension	64	7
Gravel and crushed rock	--------	1
Limestone	213,305	86
Other nonmetals, n.e.s.	--------	2
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	--------	5
Gas, hydrocarbon, natural gas	1	1
Gasoline thousand 42-gallon barrels	r 983	491
Kerosine ---do---	r 162	77
Distillate fuel oil ---do---	812	1,265
Residual fuel oil ---do---	1,019	999
Lubricants ---do---	157	76
Other ---do---	--------	31

r Revised.
[1] Less than ½ unit.

Source: Government of Jamaica, Department of Statistics, Trade Statistics Unit. External Trade of Jamaica. 1966, 319 pp.; 1967, 323 pp.

[9] Metals Week. V. 39, No. 38, Sept. 16, 1968, p. 3.
[10] Engineering and Mining Journal. V. 10, No. 4, April 1969, p. 170.
[11] Metal Bulletin. No. 5361. Dec. 31, 1968, p. 21.
[12] Metals Week. V. 39, No. 45, Nov. 11, 1968, p. 4.

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Table 19.—Jamaica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Aluminum, metal, including alloys, all forms		2,711	4,475
Copper:			
Copper sulfate		(1)	10
Metal, including alloys, all forms		270	234
Iron and steel:			
Ore and concentrate		---	2
Metal:			
Scrap		25	4
Pig iron, including ferroalloys, and similar materials		416	436
Steel, primary forms: Ingots, blooms, slabs, billets, sheet bars		441	586
Semimanufactures:			
Bars, rods, angles, shapes, sections		39,898	33,418
Wire rods and wire		5,744	4,707
Other bars and rods		864	868
Universals, plates and sheets:			
Universals and heavy plates, uncoated		8,611	9,669
Medium plates and sheets, coated		15,931	16,283
Hoop and strip		829	467
Rails and accessories		1,554	572
Tubes, pipes and fittings:			
Cast iron tubes and pipes		10,946	7,952
Welded and clinched tubes and pipes		6,202	8,861
Castings and forgings, rough, n.e.s		165	279
Lead, metal, including alloys, all forms		132	98
Nickel, metal, including alloys, all forms		2	2
Platinum group metals	value	$12,660	$6,182
Silver, metal	do	$32,124	$28,957
Tin, metal, including alloys:			
Unwrought	long tons	31	36
Semimanufactures	do	342	474
Zinc, metal, including alloys, all forms		1	21
Other:			
Ore and concentrate		2	18
Ash and residue containing nonferrous metals		2	960
Metals, including alloys, all forms		113	55
NONMETALS			
Abrasive, natural, n.e.s		r 76	20
Asbestos		185	548
Cement		2,321	2,019
Clays and clay products (including all refractory brick):			
Crude clays, n.e.s., fuller's earth, dinas, chamotte		3,427	442
Products, refractory		405	6,044
Fertilizer materials:			
Crude		375	789
Manufactured:			
Nitrogenous		21,663	37,456
Phosphatic		2,364	13,944
Potassic		8,161	10,407
Other, including mixed		31,723	11,311
Graphite, natural		7	8
Gypsum and plasters		448	173
Magnesite		(1)	18
Mica		102	187
Precious and semiprecious stone, except diamond	value	$26,670	$28,986
Salt		11,640	12,174
Sodium compounds		65,332	101,856
Stone, sand and gravel:			
Dimension stone		648	1,276
Gravel and crushed rock		65	333
Sand, including quartz		805	923
Sulfur		1,025	3,530
Other		r 628	594
MINERAL FUELS AND RELATED MATERIALS			
Asphalt		805	1,467
Coal and coke, including briquets		792	935
Gas, hydrocarbon, natural gas liquids		r 308	3,865
Petroleum:			
Crude and partly refined	thousand 42-gallon barrels	r 9,301	6,773
Refinery products:			
Gasoline	do	r 710	788
Kerosine	do	43	274
Distillate fuel oil [2]	do	165	511
Residual fuel oil [2]	do	826	2,585
Lubricants	do	61	118
Other	do	83	43
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		92	85

r Revised.
[1] Less than ½ unit.
[2] Mostly bunkers.

Source: Government of Jamaica, Department of Statistics, Trade Statistics Unit. External Trade of Jamaica. 1966, 319 pp.; 1967, 323 pp.

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Nonmetals.—*Cement.*—The Caribbean Cement Co., Ltd.,[13] set new records for production, local sales, export sales, and gross revenue. Net profit was reduced from the previous year's level because of currency devaluation in late 1967. Devaluation affected the company's profit in that a considerable portion of its supplies regularly have to be purchased from non-devalued currency sources, or in high-priced devalued areas.

With sales of 407,062 tons, the company's market was about equal to the plant's 406,420-ton annual capacity. With the construction industry in Jamaica on the upswing, the Company was negotiating with the Government for permission to erect a 100,000-ton-per-year plant in he Montego Bay area to supply domestic users. Export requirements will be served from the present deepwater bulk-loading facility at the Rockport plant. The Chairman credited Jamaica's membership in the Caribbean Free Trade Association with helping to attain record exports of nearly 99,000 tons during 1968.

MARTINIQUE

Martinique's small extractive minerals industry was limited to construction materials, largely of volcanic, or igneous origin. Salt output is reported from time to time, the most recent report of which was 120,000 cubic meters in 1967.

Total value of all commodity imports in 1967 amounted to $105.5 million, of which France supplied $77.0 million. Exports were valued at $36.0 million with $32.6 million going to France.

The first real steps toward industrialization of the island were in progress with the building of an oil refinery near Fort de France. The consortium building the 11,000-barrel-per-day refinery comprises Union Générale des Pétroles (25 percent), Compagnie Française des Pétroles (25 percent), Shell Oil Co. (24 percent), Standard Oil Co. of New Jersey (14.5 percent), and Texaco, Inc. (11.5 percent). The refinery was scheduled to go onstream in 1970.

In September, the DX Division of the Sun Oil Co. announced that it would build a $5.6 million plant near the refinery to manufacture 100,000 tons of granulated fertilizers annually. Contract for construction of the plant, to be completed in 1970, was awarded to Foster Wheeler Française, a subsidiary company of Foster Wheeler Corp.

Packing and warehousing facilities were to be installed on Guadeloupe.

[13] Caribbean Cement Co., Ltd. Summary of the Annual Statement by the Chairman, 1968.

Table 20.—Martinique: Estimated production of mineral commodities

(Metric tons)

Commodity [1]	1964	1965	1966	1967	1968 [p]
Clays	19,000	35,000	44,000	46,000	57,000
Pumice	15,000	10,000	17,580	15,000	14,970
Stone, sand and gravel:					
Crushed and broken	851,800	466,500	541,092	570,598	592,284
Sand and gravel	199,750	170,000	199,000	220,000	302,285
Other [2]	222,500	200,000	157,656	255,400	157,500

[p] Preliminary.
[1] In 1967, salt production was reported at 120,000 cubic meters.
[2] May include volcanic tuff and other materials used for fill, ballast, and other purposes.

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Table 21.—Martinique: Exports and reexports of selected mineral commodities

(Metric tons)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	10	1
Copper, metal, including alloys, all forms	------	2
Iron and steel: Metal:		
Scrap	250	1,200
Semimanufactures	152	97
Other nonferrous scrap	143	155
NONMETALS		
Cement and mineral manufactures, n.e.s	18	9
Clays and clay products (including all refractory brick)	65	23
Fertilizer materials, manufactured	------	16
MINERAL FUELS AND RELATED MATERIALS		
Gas, natural and manufactured	112	52
Petroleum, refinery products	8	26

Table 22.—Martinique: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	271	237
Copper, metal, including alloys, all forms	30	25
Gold, metal, unworked or partly worked, value	$52,000	$116,000
Iron and steel: Metal:		
Pig iron, ferroalloys and similar materials	------	1
Steel, semimanufactures	12,418	13,913
Castings and forgings	35	45
Lead, metal, including alloys, all forms	13	17
Radioactive and associated materials	------	3
Silver, metal, including alloys, value	$1,000	$1,000
Tin, metal, including alloys, all forms, long tons	2	2
Zinc, metal, including alloys, all forms	16	44
Other, scrap, nonferrous	20	3
NONMETALS		
Abrasives, natural, n.e.s	14	20
Cement and mineral manufactures, n.e.s	69,360	75,545
Clays and clay products (including all refractory brick)	3,275	3,155
Fertilizer materials:		
Crude	413	306
Manufactured	35,988	36,423
Pyrite, gross weight	12	80
Stone, sand and gravel	196	83
Other nonmetals, n.e.s.:		
Crude	3,586	4,164
Manufactured	192	148
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	93	48
Gas, natural and manufactured	5,102	4,761
Petroleum: Refinery products	88,601	98,942
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	9	7

NETHERLANDS ANTILLES

The mainstay of the economy of the Netherlands Antilles was the oil refining industry, which was estimated to have supplied about 22 percent of the gross national product (GNP) in 1967. Oil provided jobs for about 7,000 persons, slightly over 10 percent of the labor force. While of prime importance, it was noted that the share of oil's contribution to the economy has been decreasing over the years as the 1957 contribution to the GNP was 40 percent.

Part of the proportional decline was attributed to the growing value of tourism, the inauguration of light manufacturing industries, and the need of the oil industry for fewer workers. Unemployment was estimated at about 20 percent of the labor force, the loss of jobs detracting considerably from cash entering the economy.

PRODUCTION

Except for petroleum products, reported mineral output was limited to fertilizer materials and limestone. Salt is probably also produced, but statistics have not been available.

According to available refinery output figures, production over the last 5 years appears to have declined. The decline was largely in residual and distillate fuel oils.

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Table 23.—Netherlands Antilles: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS					
Fertilizer materials:					
Phosphate rock, crude---thousand tons--	r 111	r 118	147	116	93
Nitrogenous, manufactured-------do----	NA	84	NA	1 144	1 207
Stone, sand and gravel, limestone, crushed----	79,910	95,683	1 59,107	1 99,026	31,812
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline and naphthas thousand 42-gallon barrels--	41,200	43,145	44,623	37,769	33,611
Kerosine and jet fuel----------do----	19,380	18,116	20,303	38,037	38,396
Distillate fuel oil----------do----	41,187	32,762	41,319	32,224	27,035
Residual fuel oil----------do----	161,801	161,636	143,455	138,518	139,378
Lubricants including greases------do----	2,891	2,763	2,785	7,039	7,033
Asphalt----------do----	4	3	2	2	7
Other----------do----	20,231	21,705	20,358	NA	563

p Preliminary.
r Revised. NA Not available.
1 Exports or sales.

TRADE

Trade in crude petroleum and products provided 78.9 percent of the value of total commodity imports, and 96.2 percent of total commodity exports in 1967.

In regard to exports (table 24), 37 percent of the crude oil went to the United States and 17 percent to Italy. Puerto Rico took 41 percent of gasoline exports, followed by the United Kingdom with 11 percent, and lesser shipments to 57 other different countries. Canada took 45 percent of the kerosine, followed by the United Kingdom and Chile with minor quantities. The United States imported 44 percent of the jet fuel with Japan, Singapore, and Brazil next in order. Distillate fuel oil exports were shared nearly equally by the United States and Japan with 23 percent and 20 percent, respectively. The United Kingdom took 46 percent of the lubricants and the Netherlands 19 percent. Exports of residual fuel oil and miscellaneous products went to the United States, while the United Kingdom was the destination for the mineral waxes and jelly.

Referring to table 25 which shows petroleum imports, Venezuela supplied 97.5 percent of all crude oil, with minor amounts coming from Gabon, Libya, Nigeria, and Colombia, in decreasing order. In addition, Venezuela supplied nearly all of the gasoline and distillate fuel oil, and all of the residual fuel oil and liquefied petroleum gas. As for kerosine and jet fuel, 47 percent was supplied by Trinidad and Tobago and 29 percent by Venezuela. The United States supplied most of the lubricants and miscellaneous products, while mineral tar and like substances came mainly from the Netherlands.

The following tabulation shows the comparison between mineral commodity trade and total commodity trade for 1965–67:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965----------	589.6	602.8
1966----------	581.9	591.7
1967----------	601.4	612.0
Imports:		
1965----------	510.2	616.0
1966----------	498.4	616.1
1967----------	535.9	672.0

COMMODITY REVIEW

Nonmetals.—*Salt.*—International Salt Co. reported progress on its salt-recovery complex on Bonaire. Most of the condenser dikes were finished, and brines were being impounded in several ponds. Work was going ahead on dikes for the crystallizing ponds, and a pumping station was being built.

Design work was in progress for a pier to accommodate ships of 40,000 tons; loading will be by conveyor belt at the rate of 1,500 tons per hour. Energy will be supplied by the Bonaire Government.

It was expected that the first salt would be harvested by mid-1970.

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Sulfur.—Shell Curaçao N.V. opened its $15 million desulfurization plant November 22, 1967. The new plant will reduce sulfur content of the oil to 1 percent, or less. Capacity of the plant was not given.

Lago Oil and Transport Co. planned to erect an $80 million residual fuel oil desulfurization plant at its Aruba refinery. The new facility will consist of a vacuum distillation unit, a vacuum gas-oil hydrodesulfurization unit, and a sulfur recovery plant.

Table 24.—Netherlands Antilles: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel:		
Scrap	3,066	-------
Other	-------	27
Other, base metals, including alloys, all forms, n.e.s	5,781	1,994
NONMETALS		
Fertilizer materials:		
Crude, phosphatic	147,469	118,338
Manufactured:		
Nitrogenous	105,899	125,759
Other, including mixed	NA	5,520
Stone, sand and gravel:		
Limestone	19,079	-------
Sand and gravel	-------	13,228
Sulfur	1,967	-------
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	-------	267
Petroleum:		
Crude		
thousand 42-gallon barrels	2,164	3,755
Refinery products:		
Gasoline---do	37,170	37,691
Kerosine---do	8,880	4,638
Jet fuel---do	30,458	34,871
Distillate fuel oil		
thousand 42-gallon barrels	38,638	32,273
Residual fuel oil		
thousand 42-gallon barrels	126,338	133,657
Lubricants---do	7,195	7,082
Mineral jelly and wax		
thousand 42-gallon barrels	184	214
Bitumen and other residues		
thousand 42-gallon barrels	5,993	6,201
Other---do	r 11,800	10,715

r Revised.

Source: Kwartaalstatistiek Van de in-en Uitvoer Per Goederensoort Van Curaçao en Aruba, 4e Kwartaal 1967, No. 4, Nederlandse Antillen, Bureau Voor de Statistiek.

Table 25.—Netherlands Antilles: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	120	303
Copper, metal, including alloys, all forms	315	214
Iron and steel, semimanufactures	11,376	14,010
Lead, metal, including alloys, all forms	58	69
Nickel, metal, including alloys, all forms	4	11
Tin, metal, including alloys, all forms---long tons	24	11
Zinc, metal, including alloys, all forms	73	181
Other:		
Ore and concentrate, n.e.s	376	71
Nonferrous metal scrap	4,454	362
Base metals, including alloys, n.e.s	22	9
NONMETALS		
Cement	31,792	36,475
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s., fire clay	6,154	7,250
Products, refractory brick	1,105	1,677
Diamond, gem, not set or strung carats	NA	1,450
Fertilizer materials:		
Crude	15,270	4,000
Manufactured	2,707	3,542
Gypsum and plasters	NA	35
Lime	NA	265
Precious and semiprecious stone, except diamond---kilograms	NA	9
Salt	633	1,107
Stone, sand and gravel	13,594	7,320
Sodium compounds	27,725	22,430
Other nonmetals, n.e.s	9,415	506
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	59	19
Petroleum:		
Crude		
thousand 42-gallon barrels	250,089	260,624
Gasoline, natural---do	394	------
Refinery products:		
Gasoline---do	4,760	4,841
Kerosine and jet fuel		
thousand 42-gallon barrels	1,894	1,221
Distillate fuel oil---do	2,236	12,984
Residual fuel oil---do	5,142	614
Liquefied petroleum gases		
thousand 42-gallon barrels	861	472
Lubricants---do	99	170
Other [1]---do	1,935	4
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	159	27

NA Not available.
[1] Includes process oil and asphalt.

Source: Kwartaalstatistiek Van de in-en Uitvoer Per Goederensoort Van Curaçao en Aruba, 4e Kwartaal 1967, No. 4, Nederlandse Antillen, Bureau Voor de Statistiek.

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TRINIDAD AND TOBAGO

The petroleum-based economy of Trinidad and Tobago remained generally strong, buoyed by record crude oil output of 66.9 million barrels. The petroleum industry provided between 25 and 30 percent of the gross national product and the same proportion of the Government's revenue. Over 80 percent of the country's export value was provided by petroleum-based foreign sales.[14]

Declining crude output at yearend 1968 gave some sobering speculation as to the short-term aspect of the economy. The Government was taking steps to diversify economically, and actively promoted new investment in manufacturing, food processing, commercial fishing, and in urban renewal and other construction projects. Tourism was also being considered in its relation to the economy.

The Government estimates that crude oil output can be maintained at about the 1968 level through intensive drilling and the continued use of secondary recovery methods. New discoveries, too, may help the industry. Pan American (Trinidad) Oil Co. made a gas-condensate discovery off the southeast coast of Trinidad; gas flows ranged between 1.1 and 11.7 million cubic feet a day. It will probably be some time before the field can be fully evaluated. It is expected that an oil find is likely, in association with the gas.

The joint United Nations—Government of Trinidad and Tobago seismic survey of the area between Trinidad and Tobago was completed, and the records were being processed at yearend. It was expected that records would be made available to interested companies and that bids would be called for in 1969.

The Government of Trinidad and Tobago and Tesoro Petroleum Corp. of Texas agreed in principle to form a joint corporation on a 50–50 basis. Control of the corporation will rest with the Government by virtue of appointing the Chairman and

[14] U.S. Embassy, Port of Spain, Trinidad. Economic Trends Report—Trinidad and Tobago. State Dept. Airgram A-83, June 6, 1969, 8 pp.

Table 26.—Trinidad and Tobago: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
NONMETALS					
Cement, hydraulic thousand tons	176	189	209	190	NA
Clay thousand cubic meters	53	71	74	74	59
Gypsum	2,296	1,865	2,013	3,647	4,318
Fertilizer materials, manufactured, nitrogenous, gross weight thousand tons	229	280	380	530	585
Stone, sand and gravel:					
Dimension, limestone thousand cubic meters	525	435	471	435	465
Crushed and broken do.	40	61	82	17	104
Gravel and sand do.	606	245	291	189	187
Sulfur, byproduct	5,407	3,783	4,074	r 1,865	3,359
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural thousand tons	195	171	158	145	139
Sand, pitch thousand cubic meters	19	15	34	10	10
Gas:					
Natural, gross production million cubic feet	110,732	111,503	118,927	140,338	151,445
Natural gas liquids thousand 42-gallon barrels	200	197	188	183	164
Petroleum:					
Crude oil do.	49,731	48,859	55,603	64,995	66,904
Refinery products:					
Gasoline and naphthas:					
Aviation gasoline do.	977	864	2,109	1,746	519
Motor gasoline, including naphtha do.	17,747	17,208	17,868	19,524	20,850
Kerosine and jet fuel do.	11,845	17,101	16,443	15,331	19,083
Distillate fuel oil do.	19,658	19,447	19,892	19,191	18,068
Residual fuel oil do.	71,287	75,442	80,352	75,496	85,337
Liquefied petroleum gases do.	146	182	254	312	365
Lubricants do.	406	835	1,014	1,233	1,094
Asphalt, refinery do.	e 300	316	r 269	274	199
Other, including unspecified r do.	e 540	506	1,455	1,660	1,562

e Estimate. p Preliminary. r Revised. NA Not available.

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an equal number of members on the Board of Directors. The purpose of the company will be to carry on exploration and production activities and to invest in various petroleum and petrochemical ventures in Trinidad and Tobago.

The Government also announced its intention to acquire the land and marine assets of BP Trinidad, Ltd.

At yearend the Government was drafting new legislation and taxation rates relating to the petroleum industry.

Belpetco Trinidad, Ltd., a new company on the Trinidad and Tobago scene, began operations in the Gulf of Paria.

PRODUCTION

Except for crude oil, refinery products, and related materials, only construction materials, nitrogenous fertilizers, and some sulfur is produced in Trinidad and Tobago.

Nearly all categories attained increased levels of output in1968. Construction materials were in good demand because of high building activity. Rising refinery production reflects expanded capacity added over the last few years. The industry was said to be capable of producing the full range of petroleum products required by modern industry.

TRADE

Crude oil and refinery products provided 78.9 percent of Trinidad and Tobago's total exports by value in 1967. Shipments were chiefly to the United States, with minor amounts to Europe and neighboring countries. Nearly 80 percent of the volume of imported crude came from Venezuela; remaining imports came from around the world, chiefly from other South American countries, North Africa, and the Persian Gulf area.

In terms of total trade for 1967, the United States was the best export customer, taking 38.5 percent of total exports, followed by the United Kingdom (12.6 percent) and Sweden (6.3 percent). Venezuela supplied 39.1 percent of imports, followed by the United States (16.3 percent) and the United Kingdom (14.5 percent).

The following tabulation shows the comparative value of total commodity trade with that of mineral trade for the years 1965–67:

	Value (million dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	333	407
1966	369	431
1967	322	426
Imports:		
1965	237	482
1966	253	462
1967	193	449

[1] Where necessary, values have been converted at the rate of TT$1 = US$0.5882.

Source: Trinidad and Tobago. Central Statistical Office. Overseas Trade Annual Report for 1967. Part B. Summary Tables 1 to 25. 1968, p. 2.

COMMODITY REVIEW

Nonmetals.—*Porcellanite.*—A survey of the porcellanite deposits was started in order to determine the quantity and quality of the reserves. Work done by yearend 1968 covered deposits situated in Chatham, Cedros, Granville, and the Caigual/Fishing Pond areas.

Porcellanite has been used for road construction and was said to have pozzolanic properties.

Mineral Fuels.—*Petroleum.*—Trinidad Northern Areas, Ltd., was the only oil company that showed a significant increase in its production rate. Shell Trinidad, Ltd., and Premier Consolidated Oilfields, Ltd., maintained production rates, but declines at yearend were shown by BP Trinidad, Ltd., Trinidad Canadian Oils, Ltd., and Texaco Trinidad, Ltd.

A total of 942,412 feet was drilled in 1968, an increase of 14,395 feet from 1967 footage. Fewer wells were drilled in 1968 than in 1967—170 and 221, respectively. Of the 1968 total, 146 were development wells and 24 were of exploratory nature. Pan American (Trinidad) Oil Co. drilled Trinidad and Tobago's deepest well, bottoming at 16,860 feet.

A refinery throughput record was set in 1968 with the processing of 151.3 million barrels.

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Table 27.—Trinidad and Tobago: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	160	117
Copper, metal, including alloys, all forms	250	324
Iron and steel:		
Scrap	6,757	2,933
Steel, primary forms	1	7
Semimanufactures:		
Bars, rods, angles, shapes, sections	339	176
Plates and sheets, all types	490	426
Other	162	480
Lead, metal, including alloys, all forms	56	59
Nickel, metal, including alloys, all forms	1	1
Platinum group metals, platinum troy ounces	3	------
Silver, metal, including alloys, all forms troy ounces	300	------
Tin, metal, including alloys, all forms long tons	338	454
Zinc, metal, including alloys, all forms	1	(1)
Other value, US$	r 170,384	243,493
NONMETALS		
Barite, and witherite	947	305
Cement	50	2
Clays and clay products (including all refractory brick)	25	1,093
NONMETALS—Continued		
Fertilizer materials: Manufactured:		
Nitrogenous	116,901	109,960
Potassic	------	2
Other	7	4
Lime	570	2,161
Salt	11	5
Sodium and potassium compounds, n.e.s	7	3
Stone, sand and gravel	494	279
Other nonmetals, n.e.s	226	94
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	64,962	60,235
Coal and coke, including briquets	378	13
Gas hydrocarbon, manufactured	17,780	17,650
Petroleum:		
Crude and partly refined [2] thousand 42-gallon barrels	r 4,705	5,801
Refinery products:		
Gasoline do	r 13,315	15,406
Kerosine do	149	56
Jet fuel do	13,377	11,502
Distillate fuel oil do	r 19,452	18,938
Residual fuel oil do	r 78,871	77,807
Lubricants do	1,127	1,018
Other do	416	412
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	161,763	218,186

r Revised.
[1] Less than ½ unit.
[2] Government of Trinidad and Tobago, Ministry of Petroleum and Mines. Monthly Bulletin. V. 4, No. 12, December 1967, p. 2.

Source: Government of Trinidad and Tobago, Central Statistical Office. Overseas Trade, Part A. Port of Spain, 1966, 397 pp.; 1967, 405 pp.

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Table 28.—Trinidad and Tobago: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	653	784
Arsenic compounds	263	89
Copper:		
Copper sulfate	20	23
Metal, including alloys, all forms	207	115
Iron and steel: Metal:		
Scrap	218	221
Steel, primary forms, ingots	623	640
Semimanufactures:		
Bars, rods, angles, shapes, sections	11,167	11,791
Universals, plates and sheets	10,578	14,771
Tubes, pipes, and fittings	30,913	21,137
Lead, metal, including alloys, all forms	59	82
Nickel, metal, including alloys, all forms	18	4
Platinum group metals troy ounces	2,322	16
Silver, metal, including alloys, all forms troy ounces	21,319	27,922
Tin, metal, including alloys, all forms long tons	4,139	6,584
Zinc, metal, including alloys, all forms	22	24
Other scrap and ores, n.e.s US$	r 21,556	18,042
NONMETALS		
Abrasives, natural	4	1
Barite and witherite	58,545	44,739
Cement	3,815	3,004
Clays and clay products (including all refractory brick):		
Crude clays	548	774
Products:		
Refractory, including nonclay bricks	708	896
Nonrefractory	17	21
NONMETALS—Continued		
Feldspar	------	30
Fertilizer materials:		
Crude	64	43
Manufactured:		
Nitrogenous	46	33
Phosphatic	549	589
Potassic	1,514	1,585
Other, including mixed	2,350	2,228
Graphite, natural	5	------
Lime	10	8
Magnesite	27	77
Mica, all forms	25	25
Salt	9,984	9,230
Sodium and potassium compounds, n.e.s	6,256	5,062
Stone, sand and gravel:		
Dimension stone	208	28
Gravel and crushed rock	13,098	7,802
Sand	45	16
Sulfur	17,235	14,704
Other nonmetals, n.e.s	2,220	1,195
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	------	25
Coal and coke	78	392
Gas, hydrocarbon, manufactured	88	76
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	93,114	81,726
Refinery products:		
Gasoline do	r 276	315
Distillate fuel oil do	r 204	581
Residual fuel oil do		
Lubricants do	4,449	4,361
Mineral jelly and wax	621	731
Other	1,821	332
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals	r 2,035	139

r Revised.

Source: Government of Trinidad and Tobago, Central Statistical Office. Overseas Trade, Part A. Port of Spain, 1966, 397 pp.; 1967, 405 pp.

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The Mineral Industry of Central American Areas

By Burton E. Ashley [1]

CONTENTS

	Page		Page
British Honduras	843	Honduras	852
Costa Rica	844	Nicaragua	854
El Salvador	847	Panama	856
Guatemala	850		

BRITISH HONDURAS

The mineral industry of British Honduras is of little importance to the national economy. Government policy welcomes foreign investment and is extended to capable, serious companies whose efforts may make a tangible contribution to the country's economy. Considering presently known exploration campaigns being carried out within the country, it appears that the best chance for a major discovery in the near future is in petroleum.

Mineral production was limited to modest amounts of limestone and sand and gravel, as follows, in metric tons:

Commodity	1964	1965	1966	1967	1968
Limestone and marl	• 40,800	57,376	58,000	64,000	165,109
Sand and gravel [1]	NA	84,400	57,230	NA	513,106

• Estimate. NA Not available.
[1] Reportedly comprises 50 percent sand and 50 percent gravel.

Source: U.S. Consulate, Belize City.

Output was accounted for by the Public Works Department and one private firm.

Mineral foreign trade, by value, was largely in the form of petroleum reexports, while imports included metal semimanufactures, nonmetals, including fertilizer materials, and petroleum products. Traditionally, exports go to Mexico and bunkers, and imports come mainly from the United Kingdom, United States, and neighboring countries.

Value of trade in mineral commodities is compared with total value of trade in all commodities in the following tabulation:

	Value (thousand dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	182	12,212
1966	140	13,454
1967	257	12,282
Imports:		
1965	2,731	24,467
1966	2,932	27,106
1967	2,245	22,171

[1] Physical scientist, Division of International Activities.

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Table 1.—British Honduras: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel:		
Scrap	381	958
Semimanufactures	r 42	56
NONMETALS		
Cement	r 4	34
Salt	5	5
MINERAL FUELS AND RELATED MATERIALS		
Petroleum: Refinery products thousand 42-gallon barrels	14	84

r Revised.

Table 2.—British Honduras: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel, semimanufactured	3,083	1,906
Nonferrous metals, semimanufactured	137	21
NONMETALS		
Crude nonmetal minerals	595	748
Manufactured fertilizers	3,101	2,067
Cement and lime	10,430	9,797
MINERAL FUELS AND RELATED MATERIALS		
Solid, including coal, coke, and briquets	22	6
Liquid, including crude and refined petroleum thousand 42-gallon barrels	152	218

Metals.—*Iron and Steel.*—Belize Steel Products Ltd. received "development enterprise" status under the Development Incentive Ordinance. The newly formed company will build a $60,000 rolling mill to manufacture bars and rods for the local building trade. The plant will operate on remelted scrap. Jamaica Oxygen and Acetelene Co., controlled by the Liquid Carbonic Corp. of Chicago, will have a 55-percent interest in the enterprise, the remainder being held by Mexican and local interests.

Mineral Fuels.—*Petroleum.*—No development in petroleum exploration was reported during the year, but considerable acreage was held under lease. At yearend Belize Chevron Oil Co., Shell Oil Co., and Phillips Petroleum Co. had offshore and onshore leases covering some one-half of British Honduras territory. Other unidentified companies also reportedly held areas under lease.

The law governing petroleum activities is Petroleum (Production) Ordinance, Chapter 126 of the Laws of British Honduras, Revised Edition, 1958. Briefly, oil and gas rights are vested in the crown. According to the regulations, permits for various operations are granted under "Oil Exploration Licenses," "Oil Prospecting Licenses," and "Oil Mining Leases." Each class of permit carries its own limitation of size, fees, obligations, and taxes. The Oil Mining Lease provides for periodic revision of royalty rates.

COSTA RICA

Mineral production in Costa Rica does not contribute substantially to the general economy. However, exploration activity expanded rapidly with reports of mineral finds which attracted the attention of major mining companies. Kennecott Copper Corp. and a division of The International Nickel Co., Inc., opened offices in San José. American Smelting and Refining Company was also reported to be interested in exploration. Two companies which were examining sulfur prospects in Costa Rica have suspended operations, but two other companies have begun similar activity. The petroleum refinery, Refinadora Costarricense de Petróleos S.A. (Recope) at yearend had an operating deficit of about $4 million; this was in addition to some $23 million owed to other principals. At yearend a bill was submitted to the Assembly which would allow Gulf Oil Corp. to acquire a share in the refinery and to operate it. Gulf would be allowed to continue its marketing activities in Costa Rica while operating the refinery.

Fuerza y Luz, the U.S.-owned electric company, was nationalized by Government purchase of the company for a reported $10.5 million. A down payment of $1 million was to be followed by payment of the remaining debt over a period of 17½ years at an interest rate of 7.75 percent. This acquisition put nearly all of the country's electric power generation and distribution under Government control.

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Table 3.—Costa Rica: Approximate production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Gold e, troy ounces	3,000	570	570	500	500
NONMETALS					
Cement	33,000	119,000	114,750	110,500	132,177
Diatomite e	3,600	3,000	3,000	10,000	10,000
Fertilizer materials: Manufactured:					
Nitrogenous, gross weight	NA	NA	11,587	17,855	28,000
Mixed and unspecified, gross weight	NA	NA	NA	42,640	52,000
Lime e	6,500	12,000	12,000	7,759	8,000
Salt	20,000	1,848	1,930	9,804	12,000
Stone, sand, and gravel:					
Crushed and broken stone:					
Limestone and other calcareous e	126,200	219,000	229,000	229,492	230,000
Other e	50,000	172,000	172,000	172,000	175,000
Gravel and sand e	50,000	75,000	75,000	75,000	95,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline: Motor, thousand 42-gallon barrels	-------	---------	---------	175	482
Kerosine, do	-------	---------	---------	27	125
Distillate fuel oil, do	-------	---------	---------	254	858
Residual fuel oil, do	-------	---------	---------	158	460

e Estimate. p Preliminary. NA Not available.

Except for a few hundred ounces of gold, Costa Rica's annual mineral output is largely limited to cement, salt, and construction materials. The petroleum refinery began operating in 1967, using imported crude oil.

The United States is Costa Rica's most important trading partner in terms of value of both imports and exports. Most mineral and metal requirements are imported; exports are limited to small tonnages of the common metals, fertilizers, and construction materials.

The following tabulation shows value of commodity trade for the years 1965–67, compared with the value of mineral trade:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	4.9	111.8
1966	4.7	135.5
1967	5.1	143.8
Imports:		
1965	37.7	178.2
1966	27.1	r 178.5
1967	28.1	190.7

r Revised.

Metals.—*Aluminum.*—At yearend, Aluminum Company of America (Alcoa) and the Government of Costa Rica signed an agreement allowing Alcoa to build an

Table 4.—Costa Rica: Exports of mineral commodities

(Metric tons)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	34	11
Iron and steel, metal, including alloys, all forms	r 7,434	7,558
Lead, metal, including alloys, all forms	16	------
Zinc, metal, including alloys, all forms	12	------
Other, metals, nonferrous, all forms, n.e.s	142	74
NONMETALS		
Abrasives, natural	1	2
Cement	6,106	491
Clays and clay products	1,119	450
Diatomite	75	18
Fertilizer materials: Manufactured:		
Nitrogenous	12,796	11,834
Phosphatic	213	69
Other, including mixed	16,275	18,913
Gypsum	17	------
Lime	------	13
Salt	4	2
Stone, sand and gravel:		
Dimension stone	276	183
Sand and gravel	(1)	231
Other	1,680	------
Other nonmetals, n.e.s	75	19
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	5	7
Petroleum refinery products	------	19

r Revised.
1 Less than ½ unit.
Source: Ministerio de Industria y Comercio, Dirección General de Estadística y Censos, Comercio Exterior de Costa Rica. San José, Costa Rica. 1966, 420 pp.; 1967, 422 pp.

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Table 5.—Costa Rica: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	808	843
Copper:		
Copper sulfate	26	29
Metal, including alloys, all forms	284	242
Iron and steel: Metal:		
Scrap	1	13
Steel, primary forms	9,568	9,500
Semimanufactures	47,031	46,369
Lead, metal, including alloys, all forms	110	100
Nickel, metal, including alloys, all forms	5	5
Platinum-group metals and silver: Metals including alloys:		
Platinum group troy ounces	3,376	5,691
Silver do	9,002	12,925
Tin, metal, including alloys, all forms long tons	17	12
Zinc, metal, including alloys, all forms	857	1,221
Other:		
Ore and concentrate of base metals, n.e.s.	21	128
Metals, including alloys, all forms	532	3
NONMETALS		
Abrasives, natural, n.e.s.	14	7
Asbestos	141	255
Boron materials, oxide and acid	10	18
Cement	7,471	2,958
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.:		
Kaolin (china clay)	136	179
Other	608	861
Products:		
Refractory (including nonclay bricks)	233	730
Nonrefractory	78	92
Diamond, industrial	50,000	18,000
NONMETALS—Continued		
Diatomite and other infusorial earths	464	435
Feldspar	5	18
Fertilizer materials:		
Manufactured:		
Nitrogenous	29,714	28,510
Phosphatic	15,512	15,144
Potassic	13,506	19,031
Other, including mixed	19,994	26,886
Graphite, natural	5	1
Gypsum and plasters	3,340	4,493
Lime	4	6
Mica, all forms	1	2
Pigments, mineral, including processed iron oxides	6	10
Salt (including brines)	1,478	4,165
Sodium and potassium compounds, n.e.s.: Caustic soda	1,283	4,700
Stone, sand and gravel	228	491
Sulfur, elemental, all forms	60	15
Talc, steatite, soapstone, and pyrophyllite	118	205
MINERAL FUELS AND RELATED MATERIALS		
Carbon black and gas carbon	10	265
Coal and coke, including briquets	247	123
Gas, hydrocarbon: Natural gas liquids	2,502	2,742
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	r 129	795
Refinery products:		
Gasoline do	r 597	373
Kerosine do	r 119	117
Distillate fuel oil do	r 1,263	728
Lubricants do	r 77	76
Mineral jelly and wax do	2,114	2,033
Other: Bitumen and other residues	7,810	10,532
Mineral tar and other coal, petroleum, or gas-derived crude chemicals	268	244

r Revised.

Source: Ministerio de Industria y Comercio, Dirección General de Estadística y Censos, Comercio Exterior de Costa Rica. San José, Costa Rica. 1966, 420 pp., 1967, 423 pp.

alumina plant in San Isidro. The $60 million facility to be operated by a subsidiary, Alcoa de Costa Rica, Inc., will be capable of producing 400,000 tons of alumina annually. When in full operation, the estimated annual value of exports will be on the order of $25 million.

The alumina project appears to be a natural extension of the agreement by which Alcoa mines bauxite in the San Isidro area for export. The agreement, however, must be approved by the Costa Rica Legislative Assembly. Regardless of the Assembly's action, Alcoa retains the right to export a minimum of 500,000 tons of bauxite annually under its original agreement.

Alcoa's bauxite concession reportedly has reserves of 150 million tons of ore averaging 35 percent alumina.

Copper.—Reports of a copper discovery at Puriscal, near San José, generated some interest in exploration. Austin Development Corp. of Costa Rica[2] obtained concession rights to 20,000 acres and expects to spend $100,000 for a survey.

North Bordulac Mines Ltd., controlled by Pascar Oils Ltd., reportedly was examining two copper prospects near the Panama border. The properties were thought to be geologically similar to the Panamanian copper discovery made by the United Nations-Panama group.

[2] Mining Journal (London). V. 270, No. 6930, June 14, 1968, p. 489.

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Nonmetals.—*Abrasives.*—Carborundum de Costa Rica, S.A., was registered in early 1968 for the purpose of making industrial diamonds. Original capital amounted to $30,000 but the parent Carborundum Co. proposes initial investment of $60,000 in the enterprise, with further capital expansion as needed. It was reported that value of exported material could reach $1.2 million during the first year of full production. The project was approved by the Industrial Commission at midyear.

Sulfur.—The drilling program of Central Pacific Sulphur Mines, an operating company of Pascar Oils Ltd. in the Guanacaste area, reportedly indicated 4.92 million tons of ore at a grade of 15.1 percent sulfur. To confirm the discovery area, Home-Stake Production Co., in agreement with Central Pacific, will spend at least $50,000 on further drilling. Central Pacific retained an interest and will receive $200,000 from Home-Stake if that company elects to acquire the property. Development of the property, if carried out, was estimated to cost between $1.5 million and $2.5 million.

North Bordulac Mines Ltd. was interested in a 20-square-kilometer sulfur concession located 4½ kilometers south of the Pascar property.

Choquezuela Sulphur Corp., S.A., reportedly[3] a subsidiary of Kennecott Copper Corp., was examining sulfur deposits in northern Costa Rica.

Consolidated Negus Mines Ltd.[4] suspended work on the La Fontana prospect in Guanacaste Province. Preliminary work reportedly showed promising sulfur potential but the deposit contained pyrite at depth. The company continued exploration on another prospect.

Mineral Fuels.—*Petroleum.*—Continental Oil Company was awarded an exploration/development concession of 7,530 square kilometers along the Pacific coast between Quepos and the Osa Peninsula. Final approval awaited action by the Legislative Assembly.

EL SALVADOR

Production of minerals in El Salvador, while small, is diversified. Output includes aluminum and steel semimanufactures, building materials, and refinery products. Small amounts of precious metals also are probably produced each year, but the statistics are not available.

The mineral industry however does not make a large contribution to the economy of the country.

Small-scale exploration resulted in reported discoveries of precious metals and nonmetallic minerals. A firm processing marble for construction purposes was actively building an export market for its products.

[3] Engineering and Mining Journal. V. 169, No. 3, March 1968, p. 218.
[4] Mining Journal (London). V. 270, No. 6925, May 10, 1968, p. 383.

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Table 6.—El Salvador: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967
METALS				
Aluminum, metal, semimanufactures	NA	NA	NA	822
Iron and steel: Steel, semimanufactures	NA	NA	NA	24,117
NONMETALS				
Cement	53,588	80,718	142,175	143,054
Clay	11,200	14,300	NA	NA
Fertilizers, manufactured:				
Phosphatic	NA	6,222	12,551	15,663
Mixed	NA	NA	45,966	33,528
Salt, marine	21,984	22,635	19,212	NA
Stone: Limestone and seashells	75,500	95,900	213,424	245,824
MINERAL FUELS AND RELATED MATERIALS				
Petroleum: Refinery products:				
Gasoline, motor—thousand 42-gallon barrels	1,024	991	994	1,070
Kerosine and jet fuel:				
Kerosine—do	238	353	444	427
Jet fuel—do	NA	NA	NA	88
Distillate fuel oils—do	851	992	1,070	1,083
Residual fuel oil—do	1,119	664	642	577
Liquefied petroleum gas—do	32	34	51	105

NA Not available.

The United States was El Salvador's chief trading partner; most of the remaining transactions were with other countries of Latin America.

The following tabulation shows the comparison of mineral trade with the value of total commodity trade for 1965–67:

	Value (million dollars) [1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	5.5	188.7
1966	4.3	188.9
1967	10.2	207.2
Imports:		
1965	33.6	200.6
1966	34.9	r 220.0
1967	34.4	223.9

r Revised.
[1] Where necessary, values have been converted from El Salvador colones (ES¢) to U.S. dollars at the rate of ES¢1 = US$0.40.

Table 7.—El Salvador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys: Semimanufactures	66	320
Copper, metal, including alloys, all forms [1]	(2)	(2)
Iron and steel: Metal:		
Scrap	13	67
Steel, primary forms and semimanufactures [1]	3,890	12,384
Silver, metal, including alloys troy ounces	2,669	1,672
Zinc, metal, including alloys, all forms	62	77
Other, metals, including alloys, all forms	104	236
NONMETALS		
Cement	4,639	14,620
Clay products:		
Refractory (including nonclay bricks)	3	38
Nonrefractory	1,490	871
Fertilizer materials	19,574	24,119
Lime	57	50
Salt	4,813	8,564
Stone, sand, and gravel	r 166	78
Other nonmetals, n.e.s	54	49
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	------	2
Coal, all grades, including briquets	------	3
Gas, hydrocarbon: Natural gas liquids thousand 42-gallon barrels	18	52
Petroleum: Refinery products ----do	r 921	1,587

r Revised.
[1] Includes reexports of "nationalized" goods, defined as those materials upon which duties have been paid.
[2] Less than ½ unit.
Source: Anuario Estadístico, Comercio Exterior. V. 1, 1967, 818 pp.

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Table 8.—El Salvador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys:		
Unwrought	855	754
Semimanufactures	896	1,410
Copper:		
Copper sulfate	4	5
Metal, including alloys, all forms	1,737	1,653
Iron and steel:		
Ore and concentrate	------	45
Metal:		
Pig iron, ferroalloys, and similar materials [1]	785	1,103
Steel, primary forms	19,769	25,244
Semimanufactures	57,562	46,563
Other	------	9
Lead, metal, including alloys:		
Unwrought	114	152
Semimanufactures	217	222
Nickel: Metal, including alloys, all forms	------	4
Platinum group metals, including alloys, all forms...troy ounces	NA	32
Silver: Metal, including alloys...do	5,466	6,559
Tin, metal, including alloys:		
Unwrought...long tons	4	3
Semimanufactures...do	24	17
Zinc, metal, including alloys:		
Semimanufactures	485	418
Other base metal ores and concentrates	(2)	10
Other base metal scrap, n.e.s	5	30
NONMETALS		
Abrasives, natural: Pumice, emery, natural corundum, etc	10	15
Asbestos	1,241	690
Boron materials, oxide and acid	4	7
Cement	40,446	37,316
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	789	543
Products:		
Refractory (including nonclay bricks)	776	1,074
Nonrefractory	18	27
Diamond, industrial...carats	65,000	25,000
NONMETALS—Continued		
Diatomite and other infusorial earths	412	571
Feldspar and fluorspar	3	2
Fertilizer materials:		
Manufactured:		
Nitrogenous	57,850	70,849
Phosphatic	24,085	16,882
Potassic	4,006	3,181
Other, including mixed	31,745	43,424
Graphite, natural	7	12
Gypsum and plasters	2,090	7,768
Lime	1,279	1,382
Mica, all forms	6	8
Precious and semiprecious stone, except diamond...kilograms	87	109
Salt (excluding brines)	2,182	1,767
Sodium and potassium compounds, n.e.s	3,178	7,993
Stone, sand, and gravel:		
Dimension stone	1,450	3,840
Gravel and crushed rock	32	2,353
Other	791	1,402
Sulfur: Elemental, all forms	5,577	6,281
Talc, soapstone, and pyrophyllite	126	136
Other nonmetals, n.e.s	685	101
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	6,328	7,478
Coal and coke, including briquets	331	285
Gas, hydrocarbon: Natural gas liquids...42-gallon barrels	r 8,000	4,047
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	r 3,098	3,019
Refinery products:		
Gasoline...do	50	41
Kerosine...do	18	20
Gas oil, diesel oil...do	11	14
Lubricants...do	39	38
Mineral jelly and wax...do	14	12
Other: Bitumen and other residues...do	1	1
Mineral tar and other coal, petroleum, or gas derived crude chemicals	59	64

r Revised. NA Not available.
[1] Includes some scrap.
[2] Less than ½ unit.

Source: Anuario Estadistico, Comercio Exterior. V. 1, 1967, 818 pp.

Metals.—*Gold and Silver.*—Canadian Javelin Ltd.[5] was recommissioning a gold and silver mine in the Morazan Department. The El Salvador Government participated in the venture to the extent of $1 million. Ore, expected to yield some $30 per short ton in gold and silver values, will initially be produced at a rate of 100 to 150 tons daily, later to be increased to 500 tons per day.

Minerales Tepeyac, S.A., was formed with initial capitalization of $460,000. The company intends to operate on a 400-acre tract in the eastern part of the country where precious metal deposits were reported to occur. Sixty percent of the shares will probably be held within the country.

Nonmetals.—*Clay.*—A deposit of montmorillonite, believed to occur in commercial quantities, was reported. No further information was available at yearend.

Marble.—Marmoles de Centro America S.A., has established a modern plant for cutting and polishing marble near San Salvador. All 190 employees are Salvadorian nationals. Marble stock is imported from Guatemala and Costa Rica. In 1968 about 30 percent of the finished products

[5] Engineering and Mining Journal. V. 169, No. 10, October 1968, p. 149.

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were sold in Central American Common Market countries. At yearend it was announced that a U.S. firm had contracted to buy $80,000 worth of marble tile from the firm.

Sulfur.—A discovery of volcanic sulfur was reported in the province of Ahuachapán. The Government was considering the establishment of a processing plant near the discovery site.

GUATEMALA

The Guatemala mining industry continues to make its small but steady contribution to the national economy. Growth was foreseen for the base and precious metals sector and a proposed fertilizer plant should, in time, satisfy at least a part of domestic requirements and leave a small surplus for export.

In a brief speech on the economy of Guatemala in late 1968, the Minister of Economy reportedly placed great emphasis on the need for attracting private foreign investment and for developing Guatemala's mineral resources.

Mineral production followed the traditional pattern of output of precious and base metals, construction materials, and refinery products. Small increases in most commodities were noted.

Foreign trade data for 1967 were not received in time for inclusion in this chapter. No deviation in the traditional pattern was expected with the United States holding its place as Guatemala's chief trading partner.

Metals.—*Lead, Zinc, Silver.*—Minas de Oriente S.A. (Minorsa), a subsidiary of Minnesota Mining and Manufacturing Co., had a 65-square-kilometer concession and

Table 9.—Guatemala: Production of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Antimony, mine output, metal content	--------	--------	14	30	15
Cadmium, mine output, metal content, kilograms	15	17	866	NA	NA
Iron ore and concentrate [2]	7,000	8,469	10,000	10,200	3,657
Lead:					
Mine output, metal content	1,207	923	901	1,160	472
Metal, including secondary	75	114	215	71	200
Silver, mine output, metal content, troy ounces e	10,000	18,000	3,000	NA	NA
Tungsten, mine output, metal content	NA	NA	10	100	12
Zinc, mine output, metal content	844	867	903	434	NA
NONMETALS					
Cement, hydraulic, thousand tons	186	r 235	202	224	180
Clays [2]	41,044	31,906	NA	NA	NA
Feldspar	NA	NA	700	1,500	1,900
Gypsum, crude [2]	7,101	9,393	12,000	11,400	7,700
Lime	NA	17,972	17,000	18,550	17,200
Quartz	21,936	28,431	26,000	34,298	22,800
Salt, thousand tons	18	15	20	NA	NA
Stone, sand, and gravel: Crushed and broken:					
Limestone [2], thousand tons	1,071	370	371	563	580
Dolomite	NA	NA	700	1,640	2,034
Other (volcanic ash) [2]	NA	NA	28,000	44,286	42,000
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline and naphthas:					
Aviation gasoline, thousand 42-gallon barrels	--------	126	NA	NA	--------
Motor gasoline, do	447	893	1,187	1,178	1,314
Kerosine and jet fuels, do	76	210	316	r 485	547
Distillate fuel oil, do	251	719	1,139	r 2,113	1,498
Residual fuel oil, do	223	1,027	1,335	1,630	1,544
Liquefied petroleum gasses, do	27	31	49	92	79
Total, do	1,024	3,006	[3] 4,204	[3] 5,498	4,982

e Estimate. p Preliminary. r Revised. NA Not available.

[1] In 1968, Guatemala produced small amounts of jade and pumice for display purposes, and 1½ tons of copper ore for domestic use.

[2] Materials used in cement production. Other production, if any, not available.

[3] As reported.

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was concentrating exploration efforts on three old mines which were worked 15 years ago, primarily for silver. The concession area is located near Concepción las Minas where the boundaries of Guatemala, Honduras, and El Salvador meet. Ore so far outlined may total 1 million tons; reported metal values are, approximately, lead, 3 percent; zinc, 17 percent; copper, 0.75 percent; and 3 to 4 ounces of silver per ton.

A 50-ton-per-day flotation plant was being operated on an experimental basis.

Minorsa applied for two exploitation concessions of 20 square kilometers each, and one concession of 22 square kilometers, for further exploration.

If the concessions are granted, the operation will be developed on a mining basis. Destination of concentrates has not been firmly determined, but they may go to Mexico for smelting and refining.

Nickel.—Engineering for the nickel-producing facility of Exploraciones y Explotaciones Mineras Izabal, S.A., (Exmibal), near Lake Izabal, will be carried out by Gibbs and Hill, Inc, a subsidiary of Dravo Corp. Exmibal is a subsidiary of The International Nickel Company of Canada, Ltd., (80 percent) and Hanna Mining Co. (20 percent). Construction is scheduled to take about 3 years.

Nonmetals.—*Fertilizer Materials.*—Capacity of a urea plant to be established at Escuintla will be 55,000 tons per year. Costing $15 million, $12 million will be provided by the Lummus Co., the contractor; the Guatemalan Development Institute will supply $3 million but intends to sell this share to private subscribers at a later date. Petroleum feedstock from Mexico will be imported to run the 100-ton-a-day ammonia plant.

Sulfur.—The previously reported development of sulfur deposits was being held in abeyance. The Ogden Corp. found that the quantity and quality of sulfur in its Lake Ixpaco prospect did not live up to expectations. Exploration on its remaining concessions was being continued.

Mineral Fuels.—*Coal.*—Cía. Centram, S.A., jointly owned by The International Nickel Company of Canada, and Hanna Mining Co.,[6] received authority from the Ministry of Economy to search for coal in the Lake Izabal area. Rights were granted for a period of 3 years.

The known lignite deposits of Cretaceous age in Guatemala are said to be thin and probably not important. Lignites in the Izabal region are associated with Miocene and Pliocene sediments. The beds are folded and faulted.[7]

Petroleum.—The Government called for bids for exploration rights over a 48,500-square-kilometer area in the Departments of El Petén, Izabal, Quiché, and Alta Verapaz. The area was divided into 94 blocks, of which 58 were won by nine companies or individuals. U.S. interest in two lease awards was reportedly represented by Cía. Centram, S.A., and Hanna Mining Co.[8]

Work requirements on exploration leases will presumably follow rules laid down under Articles 27 through 36 of the Petroleum Code. These requirements, among others, provide a 5-year period for exploration, with some rights of renewal under certain conditions; if commercial quantities are found (or in some cases strongly indicated) the exploration right must be converted into an exploitation right. Upon conversion to a right of exploitation, 50 percent of the original lease area must be returned to the Government.

Anson Drilling de Guatemala, S.A., began the Madré Vieja No. 1 test well on the Pacific coast in April. The well had reportedly reached projected total depth of 10,000 feet in August 1968, but no details of results were available. The well was supported by Texas Petroleum Co., Mobil Exploration Guatemala, Inc., Guatemala Superior Oil Co., and Tenneco Inc.

[6] American Association of Petroleum Geologists, Bulletin. V. 52, No. 8, August 1968, p. 1407.
[7] Bohnenberger, Otto H., and Gabriel Dengo. Coal Resources in Central America. Program With Abstracts of the 1968 Annual Meeting of the Geological Society of America. November 1968, p. 30.
[8] Petroleum Press Service. September 1968, p. 351.

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HONDURAS

It was estimated that the Honduras mining industry may contribute as much as 5 percent of the national economy.

The Texaco Inc., refinery at Puerto Cortés went on stream in mid-1968, and imports of refinery products should decrease as the facility comes in to full production.

The United Nations Development Program[9] planned a 2-year program for the purpose of helping establish a Department of Mineral Resources as well as to appraise interesting mineral zones in the northeastern part of the country. The usual photogeology, geochemical, and geophysical surveys will be run over the 4,000-square-mile target area. Total cost of the project was set at $933,900 of which the Government of Honduras will contribute $371,000.

The greatest value of mineral output was in the form of base and precious metal concentrates produced chiefly by the New York and Honduras Rosario Mining Co. and Cía. Minera Los Angeles S.A. Construction materials, largely produced by private interests, rounded out the remainder of mineral output.

Trade during 1968 followed its usual pattern, the United States holding its place as Honduras' chief trading partner in terms of value.

Of the $8.9 million of mineral and metal exports, shipments of base-metal concentrates supplied over 83 percent.

The following tabulation shows comparative values between mineral trade and total commodity trade for the past 3 years:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	7.5	126.0
1966	9.0	r 145.1
1967	8.9	158.0
Imports:		
1965	10.7	122.0
1966	17.2	149.0
1967	22.2	164.7

r Revised.
Note: Where necessary, values have been converted from Honduran lempiras (L) to U.S. dollars at the rate of L1 = US$0.50.

Metals.—*Gold and Silver.*—Operations at El Mochita mine of New York and Honduras Rosario Mining Co. (NYH) proceeded satisfactorily. Quantity of ore mined and milled in 1968 was 254,525 and 253,969 tons, respectively, an increase of about 7.5 percent over figures for 1967. Assured and probable reserves at yearend stood at 1,310,623 tons with assays averaging 14.8 ounces of silver and 0.012 ounce of gold per ton, and 8 percent each lead and zinc; there was some recoverable

[9] International Financial News Survey. V. 21, No. 11, Mar. 21, 1969, p. 88.

Table 10.—Honduras: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Antimony, mine output, metal content	NA	NA	59	NA	259
Cadmium, mine output, metal content	105	97	109	113	128
Gold, troy ounces	3,401	4,090	4,274	[1] 5,924	6,150
Iron and steel, semimanufactures	---	2,331	5,064	NA	NA
Lead, mine output, metal content	7,484	9,654	11,074	11,684	13,175
Silver, thousand troy ounces	3,220	3,671	3,734	4,009	4,397
Zinc, mine output, metal content	8,568	11,126	12,393	13,086	14,783
NONMETALS					
Cement	72,843	93,966	105,020	111,036	128,750
Gypsum	4,720	6,039	11,780	13,923	NA
Salt	e 10,000	e 10,000	e 10,000	23,484	22,505
Stone:					
Dimension stone: Marble	---	---	NA	[2] 18,000	1,410
Crushed and broken	118,114	115,215	153,430	177,765	199,211

e Estimate. NA Not available.
[1] Includes 535 troy ounces of placer origin.
[2] Square meters.

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Table 11.—Honduras: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Antimony, ore and concentrate	30	34
Cadmium, ore and concentrate	513	95
Copper, ore and concentrate	r 156	------
Gold:		
Ore and concentrate troy ounces	3,473	------
Metal, worked or unworked ---do---	r 387	236
Iron and steel:		
Ore and concentrate	18	------
Metal:		
Scrap	988	480
Primary forms and semimanufactures	271	747
Lead, ore and concentrate	8,252	10,181
Silver:		
Ore and concentrate thousand troy ounces	3,456	3,495
Metal, including alloys ---do---	386	350
Zinc:		
Ore and concentrate	9,611	9,745
Metal, including alloys	------	19
Other, unspecified	173	161
NONMETALS		
Cement	27,540	29,555
Clays and clay products	42	39
Fertilizer materials, crude	48	26
Gypsum	1,438	7,066
Lime	78	157
Salt	6,474	6,500
Stone, dimension, worked and unworked	141	78
Other	84	31

r Revised.

Source: Secretaría de Economía y Hacienda, Dirección General de Estadística y Censos, Comercio Exterior de Honduras. V. 1. 128 pp. V. 2. 264 pp. Tegucigalpa, September 1968.

Table 12.—Honduras: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel:		
Scrap	2	9
Unwrought and semimanufactures	23,900	35,068
Nonferrous metals, unwrought and semimanufactured	668	1,281
NONMETALS		
Crude minerals	2,988	6,896
Cement, lime, and fabricated construction materials, except glass and clay products	5,309	7,760
Clay construction and refractory materials, fabricated	1,331	1,078
Fertilizers, manufactured	26,843	31,946
MINERAL FUELS AND RELATED MATERIALS		
Solid, including coal, coke, and briquets	180	125
Liquid, including crude and refined petroleum thousand 42-gallon barrels	2,381	2,184
Gas, including natural and manufactured	1,949	2,107
Crude chemicals, hydrocarbon-derived, and bitumen	3,545	5,519

Source: Secretaría de Economía y Hacienda, Dirección General de Estadística y Censos, Comercio Exterior de Honduras. V. 3, 1967, Tegucigalpa, September 1968, 264 pp.

cadmium. Mine development and further exploration were in progress.

Compañía Minera Los Angeles S.A. continued its exploration program at the old Opoteca silver property, last worked by the Spaniards in Colonial days.[10] Subsurface exploration reportedly indicated silver ore of requisite quantity and grade suitable for an open-pit operation. The company was also engaged in appraisal of the Yuscaran gold-silver-copper property.

Los Angeles continued its operation of the Animas mine, near Valle de Angeles; mill feed averaged 9.5 percent lead, 11.0 percent zinc, and 13.5 ounces of silver per ton.

Mountain States Development Co., Shell Mining and Equipment Co., and Standard Dredging Corp. announced plans to form a joint venture to dredge gold and silver. Values found over a 10-mile stretch of river (location not stated) were appraised at over $25 million. Sampling was done by an independent engineering firm. In addition, Mountain States acquired a one-third interest in a 5,000-ton-per-day dredge developed by Shell Mining.

Titan Wells, Inc., will hold 50 percent of Casa de Oro, a company formed as a limited partnership. A pilot-plant operation will precede larger scale mining which will be carried out over a 2-mile stretch of the Guayape River. Leases come from holdings of Cía. Centroamericana de Inversiones S.A. de C.V., which will receive 35 percent of the net profits of the established mining operation. The prospective area has not been thoroughly proven.

Iron and Steel.—Plans for the proposed Honduran steel mill (discussed in the 1965 Minerals Yearbook, Volume IV, page 109) appear to be progressing. The final feasibility study made by Ramsey and Miller, Inc., of New York, was submitted to the Central Bank of Honduras in early 1968. Among other things, the study recommended the establishment of an integrated iron and steel plant at Agalteca, about

[10] World Mining. V. 5, No. 1, January 1969, p. 43.

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30 kilometers north of Tegucigalpa. Based on anticipated Central American annual demand of more than 330,000 tons of steel billets by 1970, the study suggested construction of a mill capable of supplying 100,000 tons per year.

Charcoal blast furnaces are planned for pig iron production; steel will be made by the basic oxygen process. Raw materials will be supplied from the Agalteca area where 10.5 million tons of iron ore are known, as well as ample supplies of limestone. Charcoal will be made from eucalyptus trees cultivated for this purpose at plantations. Cost of the steel plant alone was estimated at $27.3 million, with total capital investment somewhat in excess of $35.3 million.

Planned partners in the enterprise are as follows: The National Bank for Development, the Central Bank of Honduras, Altos Hornos de Mexico, S.A., the Central-american Bank for Economic Integration, and, presumably, billet-consuming rolling mills in the general area. Various English, German, French, Italian, and Japanese firms have expressed an interest in gaining the construction contract; the successful bidder will likely be required to furnish some financing in the form of loans.

Initial technical supervision was planned under foreign leadership; some Honduran nationals are in the process of gaining metallurgical experience overseas, and the plant will in time probably be under complete Honduran management.

Mineral Sands.—Signal Exploration (Honduras) Co. was granted a 2,000-square-kilometer concession to prospect for mineral sand, particularly for titanium minerals and zircon.[11]

NICARAGUA

The minerals industry in Nicaragua was adversely affected by suspension of operations at the La Luz mine. (See Commodity Review). Floodwaters took out the hydroelectric system, and the mine was allowed to flood after removal of all underground equipment. La Luz Mines, Limited, acquired direct ownership (rather than ownership through a subsidiary) of the Rosita mine, at which property operations will be concentrated. La Luz mine had been in continuous operation for 30 years during which 17 million tons of ore had been mined and milled for a recovery of slightly more than 1.8 million ounces of gold. While mining is not of prime importance to the economy of the country, any loss of production is certain to be felt.

The United Nations Development Program-Nicaragua survey of 12,000 square miles in north and northeastern Nicaragua was guardedly optimistic about its results. Economic quantities of gold were reported in the Mascuelizo, Quailahi, Prinzapolca, and Matis rivers. Lead-zinc-silver deposits were reported along the Mascuelizo river. Silver values approaching 5 ounces per ton were found in the Las Animas-Socorro and La Libertad areas. Further evaluation is expected to be carried out under Government auspices.

It was announced in early 1968 that a contract had been signed by a group of U.S. companies headed by the Parsons Corporation to conduct the first phase of a natural resources and cadastral survey in Nicaragua. The first phase of the two-phase project will be of 3 years' duration and cover 13,000 square miles. The purpose of the survey is to point out areas where the Government can more effectively use its resources to accelerate economic development.

Trade followed traditional patterns, the United States standing as primary trading partner in value of exports and imports. West Germany and Costa Rica ranked second and third by import value, while Japan and West Germany were the next most important markets for exports.

The following tabulation shows the comparative value of mineral commodity trade and trade in all commodities for the last 3 years:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	r 11.8	148.9
1966	r 14.1	142.2
1967	14.4	151.7
Imports:		
1965	26.3	160.3
1966	23.0	181.9
1967	26.5	203.9

r Revised.

[11] Mining Journal (London). V. 270, No. 6946, Oct. 4, 1968, p. 249.

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Table 13.—Nicaragua: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Copper, mine output, metal content	9,240	10,187	9,764	9,336	11,517
Gold:					
Mine output, metal content [1] troy ounces	225,581	198,152	199,108	177,702	48,054
Metal do					144,954
Silver:					
Mine output, metal content [1] do	332,370	380,377	446,706	372,371	249,517
Metal do					166,330
NONMETALS					
Cement, hydraulic	61,052	65,859	84,349	95,924	101,601
Gypsum and anhydrite, crude	5,500	5,000	9,000	10,000	14,000
Lime	26,392	26,717	27,085	• 28,000	• 29,500
Salt: Marine	17,319	17,582	19,017	NA	NA
Stone, crushed and broken: Limestone [2] thousand tons	148	157	200	• 215	• 225
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline, motor thousand 42-gallon barrels	606	674	743	803	880
Kerosine and jet fuel do	163	152	169	218	219
Distillate fuel oil do	404	471	506	603	741
Residual fuel oil do	583	308	450	561	682
Liquefied petroleum gas do	18	27	36	46	56

• Estimate. NA Not available.
[1] In copper concentrates.
[2] For cement and lime production.

Table 14.—Nicaragua: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum	-------	3
Copper, ore and concentrate	43,268	42,249
Gold, metal, unworked or partly worked troy ounces	147,829	145,803
Iron and steel:		
Scrap	214	411
Steel, primary forms: Ingots, Semimanufactures	3,655	3,482
Silver, metal, including alloys troy ounces	447,956	181,780
Zinc, metal, including alloys, all forms	159	12
Other metals, including alloys, all forms	5	30
NONMETALS		
Cement	182	(1)
Clays and clay products:		
Crude clays, n.e.s	77	161
Lime	1	25
Salt (excluding brines)	1,059	3,548
Stone, sand and gravel:		
Dimension stone	-------	18
Gravel and crushed rock	6,314	3,378

[1] Less than ½ unit.
Source: República de Nicaragua. Memoria de la Recaudación General de Aduanas, Managua, Nicaragua. 1967, 279 pp.; 1968, 281 pp.

Metals.—*Gold and Copper.*—The hydroelectric generating facility supplying La Luz gold mine and Rosita copper mine was severely damaged by floods in August. The operating company concluded that restoration of the dam was not justified, and that to operate La Luz on diesel power was not economic. The La Luz property will be maintained in standby condition but mining operations were suspended indefinitely.

The airport and other available facilities were to be used for the benefit of Rosita operations; three diesel units were to be moved to Rosita to restore normal output.

Development work at Rosita was encouraging, and crushing and milling facilities will be expanded to handle 2,000 tons of ore daily.

Mineral Fuels.—*Petroleum.*—U.S. Natural Gas Corp. took a 6-percent interest in concessions held by Nicaragua Superior Oil Co. Toward yearend it was reported that Union Oil Co. of Central America (Union Oil Co. of California) planned to drill an offshore Caribbean test.

Esso Standard Oil, S.A., started expansion of its refinery near Managua in early 1968. Present capacity of 5,000 barrels per day throughput will be increased to 17,000 barrels per day. New additions to storage tank capacity were completed and work on actual refinery expansion was to be started by midyear. Products are to be available for southern Honduras and northern Costa Rica if marketing agreements can be arranged.

In mid-1968, offshore leases covered nearly all of Nicaragua's coastlines on both

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the Pacific and Caribbean sides. Chief lease holders were Esso companies, Shell Oil Co., and Union Oil Co.

Table 15.—Nicaragua: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, semimanufactures	757	766
Copper:		
Copper sulfate	30	32
Metal, semimanufactures	133	180
Iron and steel:		
Scrap	9	12
Pig iron, including cast iron	11	(1)
Steel, primary forms	146	31
Semimanufactures	44,432	34,728
Lead: Metal:		
Unwrought	213	111
Semimanufactures	23	10
Nickel, metal, including alloys, all forms	(1)	1
Silver, metal, including alloys troy ounces	6,334	5,787
Tin, metal, including alloys:		
Unwrought long tons	33	16
Semimanufactures do	14	7
Zinc, metal, including alloys:		
Unwrought	221	661
Semimanufactures	1,096	149
Other	6	8
NONMETALS		
Abrasives, natural, n.e.s	2	2
Asbestos	70	70
Cement	12,716	7,796
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s	875	6,139
Products:		
Refractory (including nonclay bricks)	569	301
Nonrefractory	625	695
NONMETALS—Continued		
Fertilizer materials:		
Nitrogenous	18,860	26,093
Phosphatic	14,905	24,031
Potassic	2,633	1,478
Other	3,743	5,691
Graphite, natural	4	(1)
Lime	2,115	717
Mica, all forms	1	(1)
Salt (excluding brines)	4,027	6,900
Sodium and potassium compounds, n.e.s	2,982	2,739
Stone, sand and gravel	256	586
Sulfur	313	56
Other nonmetals, n.e.s	------	68
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	3	(1)
Coal, all grades, including briquets	25	14
Coke and semicoke	84	59
Gas, hydrocarbon: Natural gas liquids	203	601
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	r 1,445	2,348
Refinery products:		
Gasoline do	128	104
Kerosine do	83	95
Residual fuel oil do	104	99
Lubricants	5,476	7,286
Mineral jelly and wax	1,380	1,151
Other: Petroleum coke	8,838	6,056
Mineral tar and other coal, petroleum, or gas derived crude chemicals	8,355	9,193

r Revised.
1 Less than ½ unit.

Source: República de Nicaragua. Memoria de la Recaudación General de Aduanas, Managua, Nicaragua. 1967, 279 pp.; 1968, 281 pp.

PANAMA

Panama's small minerals industry was largely based on imports of crude oil for domestic refining, and some metals for fabrication; it was of importance to the country in supplying both local and export markets. The extractive industry was limited to output of salt and nonmetallic minerals for cement manufacture.

Exploration under United Nations auspices has revealed possibilities for future copper production. Thirty-eight mining companies have reportedly expressed an interest in further exploration of the newly discovered prospects.

Petroleum refining progressed with the capacity of Refinería Panamá, S.A.,[12] increased from 55,000 barrels per day to 70,000 barrels per day at a cost of $3.5 million.

There was also some talk of a $30 million U.S.-financed project to build a pipeline across the isthmus. Purpose of the line would be to transport crude oil between the Atlantic and Pacific coasts to avoid the inconvenience of large tankers having to transit the Canal.

Crude oil and refined products rank highest in value of individual mineral commodity exports and imports. While the United States was Panama's chief trading

[12] Petroleum Times. V. 72, No. 1859, Nov. 8, 1968, p. 1620.

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Table 16.—Panama: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967
METALS				
Aluminum, semimanufactures	360	338	e 630	NA
Iron and steel, steel, semimanufactures	12,500	11,000	e 13,000	NA
NONMETALS				
Cement:				
Hydraulic	125,178	165,640	149,817	NA
Other	409	978	e 700	NA
Clay and shale	43,227	133,707	40,844	NA
Salt	11,181	11,648	8,922	10,656
Stone, crushed and broken [2]	e 211,700	208,991	124,696	NA
MINERAL FUELS AND RELATED MATERIALS				
Petroleum: Refinery products:				
Gasoline, motor—thousand 42-gallon barrels	2,047	2,445	2,920	2,776
Kerosine and jet fuel:				
Kerosine—do	581	770	586	868
Jet fuel—do	375	377	683	1,301
Distillate fuel oils—do	4,525	3,235	6,350	4,864
Residual fuel oil—do	6,714	6,378	8,699	9,292
Other—do	367	3,225	574	216

e Estimate. NA Not available.
[1] Panama also produces sand, gravel, and crushed rock.
[2] Limestone and siltstone for cement manufacture.

partner in value of total commodities, Venezuela ranked high in value of crude oil supplied.

The following tabulation compares value of total commodity trade with that of mineral commodities for the years 1965–67:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	24.5	70.2
1966	26.5	79.6
1967	23.0	85.9
Imports:		
1965	50.3	189.6
1966	54.2	214.5
1967	63.6	229.4

Table 17.—Panama: Selected exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel:		
Scrap	23	------
Unwrought and semimanufactured	6	2
Nonferrous metals:		
Base metal residues	1,116	1,406
Unwrought and semimanufactured	74	139
MINERAL FUELS AND RELATED MATERIALS		
Liquid, including crude and refined petroleum thousand 42-gallon barrels	10,057	8,157

Source: República de Panamá, Dirección de Estadística y Censo. Estadística Panamena. Comercio Exterior, Año 1967. Serie "K", No. 1, 68 pp.

Metals.—*Copper and Molybdenum.*—The joint prospecting campaign carried on by the United Nations and the Government of Panama in the Azuero area gave hope of copper and molybdenite production in the future. A report [13] was issued by the Panama Government outlining preliminary information on the find.

The porphyry-type copper deposit was outlined by a combination of geological and geochemical techniques. An exploratory drill hole inclined at 45° had reached 66 meters at the time of the report. After passing through 16 meters of overburden, the remaining 50 meters of core averaged 0.95 percent copper and 0.028 percent molybdenum. Ore minerals thus far determined are chalcopyrite, chalcocite, bornite, and covellite. Host rock was determined as quartz monzonite.

The Government had not let any concessions by yearend, but had granted several firms the right to carry out surface studies in the area. Companies showing interest in the deposit were from Japan, West Germany, Canada, the Republic of South Africa and the United States.

It was expected that concessions might be arranged in 1969, presumably after more information on the deposit is compiled, and revisions of the mining code are completed.

[13] Province of Colón, Panamà, Ad Hoc Report on Area 65-Cerro Petaquilla. May 1968, Pub. No. 2, 10 pp., with appendices and maps.

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Table 18.—Panama: Selected imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	1,989	2,492
Copper:		
Copper sulfate	16	NA
Metal, including alloys:		
Semimanufactures	207	NA
Iron and steel:		
Pig, scrap and ferroalloys	491	2,008
Steel, primary forms	9,680	18,993
Semimanufactures	34,927	32,698
Lead, metal, including alloys, all forms	225	NA
Platinum group, metals, including alloys, all forms—troy ounces	129	NA
Silver, metal, including alloys—do	12,700	NA
Tin, metal, including alloys, all forms—long tons	15	NA
Zinc, metal, including alloys, all forms	2	NA
Other, base metals, including alloys, all forms, n.e.s	282	NA
NONMETALS		
Asbestos	49	236
Abrasives, natural, n.e.s.:		
Emery, corundum, pumice	1	NA
Cement	4,055	NA
Clays and clay products (including refractory brick):		
Crude clays, n.e.s	406	NA
Products, refractory	512	NA
Diatomite and other infusorial earths	148	NA
NONMETALS—Continued		
Fertilizer materials:		
Crude	139	NA
Manufactured	23,277	31,590
Gypsum	6,381	NA
Lime	786	NA
Mica, all forms	6	NA
Salt	293	NA
Sodium compounds, n.e.s	1,385	NA
Stone, sand, and gravel:		
Dimension stone	699	NA
Quartz and quartzite	74	NA
Sand	4	NA
Sulfur	6	NA
Talc, soapstone, and pyrophyllite	248	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	1,872	NA
Petroleum:		
Crude and partly refined thousand 42-gallon barrels	20,328	19,975
Refinery products:		
Gasoline—do	4	NA
Kerosine—do	4	NA
Distillate fuel oil—do	111	92
Residual fuel oil—do	29	154
Lubricants—do	12	39
Other—do	11	28
Mineral tar and other coal, petroleum, or gas derived crude chemicals	8	NA

NA Not available.

Source: República de Panamá, Dirección de Estadística y Censo. Estadística Panameña. Comercio Exterior, Año 1967. Serie "K", No. 1, 68 pp.

The Government proposed that the United Nations extend its work in other areas on the strength of present prospects. The project would continue over a 39-month period. Of the total estimated cost of $3.7 million, Panama would contribute $1.4 million.

Iron Ore.—The Government was trying to create interest in magnetite sands lying along the Pacific coast, with a view to recovery and export. A U.S. engineering firm reportedly made a preliminary feasibility study of the project in 1967, but no further information is available.

Manganese.—Dravo Corp. reportedly continued development of its manganese property in Colón Province. Prospecting, road building, and construction of service buildings, were said to be nearing completion. Ore production may soon follow.

Mineral Fuels.—*Petroleum.*—Esso Exploration and Production of Panama reportedly paid the first year concession fee for exploration rights in Panama and Darién Provinces.

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The Mineral Industry of Other South American Areas

By Burton E. Ashley [1] and F. W. Wessel [1]

CONTENTS

	Page		Page
Ecuador	859	Paraguay	865
French Guiana	861	Surinam	867
Guyana	863	Uruguay	870

ECUADOR [2]

The most encouraging mineral industry news in 1968 was the continued success in petroleum exploration in northeast Ecuador. With construction of a trans-Andean pipeline to the Pacific, and development of this petroleum area to its full economic potential, the Ecuador mineral economy should assume some importance to the country.

Silver production for 1968 showed a marked increase of 71 percent over the 1967 level; most other commodities also showed some increases with the chief exception of crude petroleum.

[1] Physical scientist, Division of International Activities.
[2] Prepared by Burton E. Ashley.

Table 1.—Ecuador: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Cadmium, mine output, metal content--kilograms	2,141	1,239	556	756	404
Copper, mine output, metal content	171	129	223	415	557
Gold, mine output, metal content---troy ounces	17,681	11,512	10,901	6,738	8,659
Lead, mine output, metal content	166	114	69	NA	NA
Silver, mine output, metal content---troy ounces	117,126	69,966	76,710	79,657	136,204
Zinc, mine output, metal content	380	236	135	161	114
NONMETALS					
Cement---thousand tons	288	325	[r] 378	[e] 390	434
Clays, kaolin	[r] 336	[r] 195	891	372	642
Sulfur	236	232	[r] 114	NA	147
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite	35	33	68	64	71
Petroleum, crude---thousand 42-gallon barrels	[r] 2,887	[r] 2,921	2,660	[r] 2,272	1,815
Natural gasoline---do	119	128	110	119	113
Refinery products:					
Gasoline---do	2,037	2,157	2,160	2,277	2,783
Kerosine and jet fuel---do	478	627	762	849	971
Distillate fuel oil---do	859	963	1,044	1,200	1,489
Residual fuel oil---do	1,296	1,480	1,501	NA	1,901
Other---do	169	252	285	194	43

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.
[1] Salt is also produced in Ecuador, but statistics are not available.

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Trade followed its usual pattern with mineral imports consisting primarily of iron and steel products, fertilizer materials, and various forms of petroleum.

The following tabulation shows the comparison of total commodity trade with trade in mineral commodities for the period 1964 through 1966.

	Value (million dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1964	1.5	130.8
1965	3.0	131.9
1966	.75	140.0
Imports:		
1964	23.0	151.9
1965	31.4	144.2
1966	24.9	152.0

[1] Where necessary, values have been converted from sucres (S/) to U.S. dollars at the rate of S/18 = US$1.

Source: República del Ecuador. Junta Nacional de Planificación y Coordinación. Departamento Tecnico. Anuario de Comercio Exterior. Quito, Ecuador, v. 2, 1966, 564 pp.

The United States was Ecuador's chief trading partner in 1966, having received 51 percent of total commodity exports, and supplying 40 percent of like imports.

Table 2.—Ecuador: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965	1966
METALS		
Copper, scrap	2	-----
Gold, concentrate (calaverite)	5	5
Iron and steel: Metal:		
Scrap	65	89
Semimanufactures	3	9
Lead, concentrate	707	671
Zinc, concentrate	562	215
MINERAL FUELS AND RELATED MATERIALS		
Petroleum, crude thousand 42-gallon barrels	379	652

Source: República del Ecuador. Junta Nacional de Planificación y Coordinación. Departamento Tecnico. Anuario de Comercio Exterior. Quito, Ecuador, v. 2, 1965, 581 pp.; v. 2, 1966, 564 pp.

COMMODITY REVIEW

Metals.—Cía. Siderúrgica de la Sabana reportedly purchased a pig iron plant from West Germany valued at $1.5 million. The plant, with initial capacity of 30,000 tons annually, will be constructed at Tibitó. Domestic deposits of iron ore, coal, and limestone are to provide feed for the plant.[3]

Nonmetals.—*Cement.*—In early 1968 it was reported that the cement plant of Industrias Guapán, S.A., was having production difficulties. Contract lignite deliveries from the Biblián deposits were below amounts needed, and oil-fired furnaces had to be put into operation to make up the energy shortage. Costs of operation rose above estimated levels, and it was proposed that the lignite operation be closed.

Salt.—Morton International, Inc. Ltd., owns a 50-percent interest in Cía. Ecuatoriana de Sal y Productos Quimicos, C.A., with headquarters in Guayaquil. Solar salt recovery operations being built at Salinas were expected to be ready for commercial production in mid-1968.

Mineral Fuels.—*Coal.*—Coal deposits in the Loja and Malacatos basins in southern Ecuador near the Peru border, and in the Cañar-Azuay basin near Cuenca were described.[4] The Biblián coal belt, which is the best known, has two zones of lenticular seams, parts of which are of minable thickness from place to place. The coal is subbituminous with high ash and sulfur content. Coal from the Biblián deposits has not been successfully used in any large commercial enterprise.

Petroleum.—By yearend the Texaco-Gulf (Cía. Texaco de Petróleos del Ecuador, C.A., and Gulf Ecuatoriana de Petróleos, S.A.) combine had completed its ninth successful well in the Oriente Province of northeast Ecuador. Estimated potential was around 15,000 barrels of oil a day. The companies proposed building a pipeline from the producing area to an as yet undetermined port on the Pacific. The pipeline, to be built entirely within Ecuador, will cross the Andes mountains at an elevation of about 10,000 feet.[5] Final contract renegotiations between the Government and the companies have delayed development as well as start of work for the pipeline.

The number of wells drilled in Ecuador has steadily decreased since 1964, with

[3] Metal Bulletin. No. 5397, May 9, 1969, p. 27.
[4] O'Rourke, J. E. Coal Deposits of Ecuador. Program with Abstracts of the 1968 Annual Meeting of the Geological Society of America. November 1968, p. 227.
[5] World Oil. V. 167, No. 1, July 1968, p. 158.

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Table 3.—Ecuador: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1965	1966
METALS		
Aluminum:		
Oxide (alumina) and hydroxide	r 9	16
Metal, including alloys, all forms	667	588
Arsenic, white	3	2
Copper, metal, including alloys, all forms	657	562
Gold, metal, including alloys, all forms—troy ounces	289	1,350
Iron and steel:		
Scrap	(1)	3
Pig iron, ferroalloys, and similar materials	40	60
Steel, primary forms	217	3,208
Semimanufactures	57,298	70,888
Lead:		
Oxide (litharge)	76	176
Metal, including alloys, all forms	275	375
Mercury—76-pound flasks	8	6
Nickel, metal, including alloys, all forms—kilograms	1,066	303
Platinum-group metals, including alloys, all forms—troy ounces	64	------
Silver, metal, including alloys, all forms—do	450	67,934
Tin, metal, including alloys, all forms—long tons	26	31
Titanium, metal, including alloys, all forms	220	251
Zinc, metal, including alloys, all forms	78	52
Other metals, including alloys, n.e.s	3	3
NONMETALS		
Abrasives, natural, n.e.s	11	10
Asbestos	954	375
Barite and witherite	461	781
Boron materials	18	11
Cement	2,322	2,214
Chalk	417	520
Clays and clay products (including all refractory brick):		
Bentonite	424	467
Kaolin (china clay)	9	85
Other	r 90	301
NONMETALS—Continued		
Diatomite, and other infusorial earths	338	313
Fertilizer materials, crude and manufactured:		
Nitrogenous	11,820	9,208
Phosphatic	5,737	9,769
Potassic	5,677	5,546
Other, including mixed	860	4,403
Graphite, natural	3	(1)
Gypsum and plasters	57	33
Magnesite	12	4
Mica, all forms	27	29
Precious and semiprecious stone, except diamond—kilograms	2,463	2,058
Salt (excluding brines)	163	64
Sodium compounds	3,800	3,692
Stone, sand, and gravel:		
Dimension stone	158	251
Sand, including quartz	429	29
Sulfur	151	161
Talc, soapstone, and pyrophyllite	175	196
Other nonmetals, n.e.s	33	14
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	9,458	225
Carbon black	576	573
Coal, all grades, including briquets	314	121
Coke and semicoke	160	360
Petroleum:		
Crude thousand 42-gallon barrels	3,032	5,878
Refinery products:		
Aviation gasoline—do	137	e 94
Jet fuel—do	72	e 15
Gas oil, diesel oil—do	(1)	e 6
Lubricants—do	53	56
Mineral jelly and wax—do	31	e 30
Other—do	4	e 2
Mineral tar and other coal, petroleum or gas derived crude chemicals	104	170

e Estimate. r Revised.
1 Less than ½ unit.

Source: Anuario de Comercio Exterior. V. 2, 1965, 581 pp.; V. 2, 1966, 564 pp.

only 25 completed in 1967. The total number of producing wells has decreased from 1,063 in 1964 to 864 in 1967. Production also continued to drop from 2.9 million barrels in 1964 to 1.8 million barrels for the current year. Consumption of refinery products was estimated at 6.1 million barrels in 1967.

FRENCH GUIANA [6]

A project to mine bauxite in French Guiana was the only new mineral development reported in 1968.

Production of columbite-tantalite appeared to have ceased, at least temporarily. Gold output was valued at around $180,000 and output of common sand, gravel, and crushed stone was valued at over $2.5 million.

Trade in mineral commodities was minimal. Gold is exported to France. Imports followed the normal pattern, the most important being metal semimanufactures, cement, and refined petroleum products.

The United States received the largest

[6] Prepared by Burton E. Ashley.

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Table 4.—French Guiana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Columbite and tantalite---kilograms	1,000	850	1,000	1,000	------
Gold---troy ounces	NA	NA	r 632	7,584	5,099
NONMETALS					
Clays	NA	NA	3,500	2,400	10,000
Stone, sand and gravel:					
Crushed and broken	70,200	NA	141,075	481,250	707,840
Sand	NA	NA	1,700,000	465,800	103,900

r Revised. NA Not available.

share of exports, while France, as expected, supplied most of the imports by value.

The following tabulation compares value of total commodity trade with that of mineral commodity trade for 1965 to 1967.

	Value (thousand dollars)[1]	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	17	2,899
1966	9	3,451
1967	52	3,784
Imports:		
1965	1,755	20,053
1966	3,105	27,802
1967	4,657	42,118

[1] Source has converted francs to dollars at the rate of 1,000 francs =$202.55.

Source: Statistical Office of the European Communities. Associates—TOM—DOM, Foreign Trade Statistics, No. 4, 1968, pp. 217–233.

COMMODITY REVIEW

Metals.—*Bauxite.*—The Aluminum Company of America (Alcoa) and Compagnie Péchiney reportedly reached agreement with the French Bureau de Recherches Geologíques et Minières to develop bauxite deposits in French Guiana. Further permission must be obtained from the Governments of Surinam and France, because the bauxite would be barged to Alcoa's plant in Surinam for treatment. Alcoa and Péchiney would participate in the project on a 75–25 percent basis, respectively.

Various unconfirmed reports have put bauxite reserves at 50 to 60 million tons of ore averaging 50 to 65 percent alumina and less than 1 percent silica.

Gold.—Gold was recovered from alluvial workings near Paul Isnard. The company,

Table 5.—French Guiana: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	222	137
Copper, metal, including alloys, all forms	9	25
Gold, metal, unworked or partly worked---value	$25,000	$38,000
Iron and steel:		
Metal: Pig iron and ferro-alloys	1	5
Steel:		
Ingots	------	16
Semimanufactures	5,391	7,773
Castings and forgings	64	181
Lead, metal, including alloys, all forms	9	8
Zinc, metal, including alloys, all forms	4	16
NONMETALS		
Cement	15,859	33,981
Fertilizer materials:		
Crude	------	12
Manufactured	28	72
Stone, sand, and gravel	11	106
Other crude minerals	2,186	347
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	9	12
Gas, natural and manufactured	453	589
Petroleum: Refinery products thousand 42-gallon barrels	103	202

Compagnie Minière Paul Isnard, was reportedly U.S.-owned and backed by U.S. capital. Output, which may be currently more than 1 kilogram of gold daily, is all sold to France.

In 1968, the mine employed 25 to 30 laborers from neighboring countries, and four heavy-equipment operators to run the two bulldozers and one dragline. Gold recovery is effected by mercury amalgamation.

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GUYANA [7]

Production and export of bauxite and its products again was Guyana's chief mineral activity. Total bauxite production was about 5 percent greater than in 1967, production of calcined grades increased 13 percent, and dried bauxite exports were up 7 percent. Alumina production remained essentially unchanged from that of the previous year.

Production of manganese ore ceased late in the year. Gold production increased 72 percent and diamond production declined by one-third.

Development loans for a total of $6 million were negotiated with the United Kingdom and Canada; the Canadian loan was specifically for the purpose of control surveys and topographic mapping. A total of $970,000 was set aside for topographic and geologic surveys in Guyana's 1968 budget.

The expansion programs of both Reynolds Guyana Mines, Ltd., and Demerara Bauxite Co., Ltd. (DEMBA), were essentially complete by the end of March. Also completed early in the year was the modern highway from Georgetown to Mackenzie, center of DEMBA's bauxite activity. A contract was awarded for construction of a similar road from New Amsterdam southeastward to the Surinam border.

The proposed hydroelectric facility at Tiboku, with its implication of aluminum smelting facilities, remains under serious consideration. Any decision to proceed may come as early as 1969.

Exploration in Guyana's portion of the Precambrian Shield, conducted by the Guyana Geological Survey, continued to progress. Copper, molybdenum, and nickel mineralizations were being measured and studied.

Official data on foreign trade through 1967 are incomplete; however, figures are available for the major commodities. Exports of dried metallurgical-grade bauxite increased 19 percent from 1966 to 1967, and preliminary 1968 figures show a further increase of 6 percent. Exports of calcined bauxite and of alumina were off 7 and 9 percent, respectively.

Manganese ore exports in 1967 were substantially unchanged from 1966, but preliminary figures for 1968, the terminal year for Union Carbide Corp.'s Matthews Ridge operation, showed a 33-percent decline.

Guyana's membership in the Caribbean Free Trade Association (CARIFTA) has not yet had any discernible effect on exports of mineral commodities. However, formation of an association of Caribbean bauxite-producing countries—Dominican Republic, Guyana, Haiti, Jamaica, and

[7] Prepared by F. W. Wessel.

Table 6.—Guyana: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968 [p]
METALS					
Aluminum:					
Bauxite, gross weight [2]---thousand tons	2,518	2,919	3,358	3,390	NA
Metallurgical and chemical grades---do	1,447	1,905	2,202	2,401	1,957
Abrasive and refractory grades [e] [3]---do	823	[r] 972	[r] 882	819	929
Alumina, gross weight	296,255	279,070	301,719	273,227	269,540
Gold---troy ounces	2,111	2,077	3,045	2,379	4,088
Manganese ore and concentrate	[r] 128,836	[r] 164,761	[r] 173,585	178,552	130,760
NONMETALS					
Diamond:					
Gem---metric carats	60,325	45,150	39,555	[e] 40,946	[e] 27,890
Industrial---do	49,357	67,724	59,332	[e] 56,406	[e] 38,421
Total---do	109,682	112,874	98,887	97,352	66,311
Stone, sand, and gravel:					
Stone, crushed and broken	NA	94,688	155,615	138,179	NA
Gravel and sand [4]	NA	3,034	4,680	NA	NA

[e] Estimate. [p] Preliminary. [r] Revised. NA Not available.

[1] In addition to the commodities tabulated, Guyana produces clay and additional quantities of stone, but quantitative data are not available.

[2] Production on which royalties were collected by the Government. Data apparently not corrected for free moisture content.

[3] Figures represent weight before calcining, estimated by applying a factor of 1.75 to calcined weight.

[4] Stone sand from Government quarries only.

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Table 7.—Guyana: Exports of principal mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Bauxite:			
Dried	r 1,555,899	1,853,005	Canada 961,915; United States 874,972.
Calcined	r 500,540	466,172	United States 230,576; United Kingdom 48,486.
Oxide (alumina)	r 301,803	278,224	Canada 108,819; Norway 85,357.
Gold—troy ounces		262	NA.
Manganese, ore and concentrate	r 197,220	194,744	Mainly to Trinidad and Tobago.[2]
NONMETALS			
Diamond, all grades—carats	92,085	98,933	NA.
Stone, sand, and gravel: Gravel and crushed rock.	437	390	All to Surinam.[3]

r Revised. NA Not available.

[1] In addition to tabulated commodities, Guyana exports small quantities of ferrous and nonferrous scrap, gold, and clay, for which data have not been published since 1962.

[2] In transit. Most of quantity shown was destined for transshipment to the United States.

[3] Imports from Guyana by Surinam.

Sources: Guyana Ministry of Economic Development. Statistical Bureau: Monthly Account of External Trade, December 1966; December 1967.

Table 8.—Guyana: Selected imports of mineral commodities[1]

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel: Semimanufactures	15,016	22,688
NONMETALS		
Asbestos	402	291
Cement	53,704	81,460
Fertilizer materials, manufactured, nitrogenous	23,617	28,052
Lime	1,578	1,885
Sodium compounds, n.e.s.: Hydroxide	27,670	22,556
Stone, sand, and gravel: Limestone	5,604	11,751
MINERAL FUELS AND RELATED MATERIALS		
Petroleum: Refinery products:		
Gasoline—thousand 42-gallon barrels	241	223
Kerosine—do	239	178
Gas oil—do	482	570
Diesel oil—do	56	60
Residual fuel oil—do	1,470	1,981
Lubricants—do	391	524

[1] Published official data lack detail in several classifications. Where available, supplementary data from other sources are used.

Source: Guyana Ministry of Economic Development. Statistical Bureau: Monthly Account of External Trade, December 1966; December 1967.

Surinam—has been proposed and is being considered.

COMMODITY REVIEW

Metals.—*Aluminum.*—The effects of recent expansion of facilities by both Reynolds and DEMBA, essentially complete by the end of the first quarter, began to be noted in terms of increased production of bauxite and related commodities. A strike interrupted production at DEMBA for a week late in May; no other labor trouble was reported.

Copper.—Drilling of the copper deposit at Groete Creek, opposite Stampa Island on the Essequibo River, continued throughout the year. A deposit of 100 million tons of rock containing 0.2 percent copper has been blocked out; within this area is a band of 17 million tons containing 0.6 percent copper and about one-half ounce of gold per ton. Geologists were also investigating copper showings in the upper

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Demerara Valley, and in the Blue and Oko Mountains in the Puruni River basin.

Gold.—Production in 1968 showed a major gain over that of 1967, primarily due to increased output from the Mazaruni district. This district accounted for 73 percent of Guyana's output during the first half of the year, more than making up for the decline in the North-West district. Canadian interests reportedly are reopening an old gold mine in the Puruni River area, last worked in 1904–05.

Manganese.—The continued decline in ore grade at Matthews Ridge, coupled with the increasing world availability of higher grade ores and a decline of ore prices, led to the closure of this mine by Manganese Mines Management, Ltd., a Union Carbide Corp. subsidiary, in the last quarter of 1968. About 450 employees were affected. The Guyanese Government will take over the company assets in Guyana, and may decide to continue the operation.

Nickel.—Nickel mineralization was being drilled near Wanamo, on the Barima River, and a geochemical study of the Mariwa district, in the Cuyuni basin, was underway.

Radioactive Minerals.—Two applications for exploration licenses have been filed. If granted, radioactive ores will be sought in the upper Mazaruni Valley and in the area between the Berbice and Essequibo Rivers, about 160 miles south of Georgetown.

Nonmetals.—*Diamond.*—The decline in Guyana's diamond production was almost entirely attributable to the Mazaruni district, Guyana's largest. From an average monthly production of 6,300 carats over a 5-year period, output was down to an average of less than 3,500 for the first half of 1968 (latest available data).

Ceramic and Construction Materials.—Government geologists determined the presence of 20 million tons of stone, suitable for various construction purposes, near Bartica.

The Guyanese Community Development Division began a campaign to foster local production of building bricks from common clay, which is apparently in adequate supply. Earthenware ceramic products were being produced and marketed. Kaolin is known to exist beneath some of the bauxite, and was reported to be of potential value.

Mineral Fuels.—*Petroleum.*—No further offshore drilling was undertaken during 1968 by either Guyana Shell, Ltd., or the Tenneco Oil Co.-Continental Oil Co. joint venture. There was no change in concession holdings.

PARAGUAY [8]

The mineral industry of Paraguay is of little importance except for output of construction materials and refinery products for domestic use.

Petroleum interests were active in appraising the general prospects for exploratory work, but no firm commitments had been made by yearend.

The cement plant at Valle-mí is expected to commence operations in 1969 with an expected output of 100,000 tons annually. This production should be ample to satisfy domestic needs.

A proposed plant to produce steel semimanufactures will bring such industry to Paraguay for the first time.

No metallic minerals or metal semimanufactures were produced in Paraguay; nonmetallic construction minerals were produced primarily for domestic use except for some small quantities exported to Argentina.

In its first 3 years of operation, the petroleum refinery near Asunción has raised output from 381,000 barrels of products annually to 1.3 million barrels, a gain of over 200 percent.

In terms of value, about one-half of Paraguay's export trade was shared by the United States and Argentina in nearly equal amounts. Great Britain and The Netherlands were next in importance. Nearly 40 percent of the import trade was shared nearly equally by the United States and Argentina, with Germany ranking third.

Mineral exports were limited to small tonnage shipments of crushed rock and sand and petroleum products, while imports comprised chiefly ferrous and nonferrous semimanufactures, crude oil, and refinery products. Among the nonferrous group, recorded imports were limited to

[8] Prepared by Burton E. Ashley.

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Table 9.—Paraguay: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
NONMETALS					
Cement	22,500	28,800	25,739	14,423	23,800
Clays:[1]					
Kaolin	55	57	60	140	180
Other	300,000	320,000	360,000	380,000	395,000
Gypsum, crude	780	2,200	2,500	1,800	2,300
Lime	17,800	18,500	17,610	17,600	18,200
Pigments, natural mineral, iron oxide: [1] Ocher	55	60	10	22	25
Stone, sand and gravel:[1]					
Dimension stone	50,150	54,200	49,450	53,200	57,860
Crushed and broken:					
Limestone	67,200	70,000	67,000	50,500	61,500
Other	1,180,000	1,000,000	1,210,000	1,280,000	1,310,000
Sand, excluding glass sand	185,000	230,000	300,000	340,000	360,000
Talc, soapstone and pyrophyllite	47	140	60	72	75
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Refinery products:					
Gasoline—thousand 42-gallon barrels	---	---	124	333	421
Kerosine and jet fuel:					
Kerosine—do	---	---	42	122	124
Jet fuel—do	---	---	6	55	50
Distillate fuel oil—do	---	---	130	403	474
Residual fuel oil—do	---	---	74	196	182
Liquefied petroleum gas—do	---	---	5	15	18

[1] Based on industry or Government estimates.

Source: U.S. Embassy, Asunción.

products of aluminum, lead, copper, tin, and tinplate.

The following tabulation shows the relationship between value of mineral commodity trade and total commodity trade for the period 1965–67:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	0.351	r 57.3
1966	.6	r 49.4
1967	.372	48.3
Imports:		
1965	9.3	47.4
1966	11.2	r 50.2
1967	12.3	60.7

r Revised.

Source: Banco Central del Paraguay, Departamento de Estudios Económicos. Boletin Estadístico Mensual. Asunción, Paraguay, No. 129, February 1969, 81 pp.

Table 10.—Paraguay: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodities	1966	1967
METALS		
Iron and steel, unwrought and semimanufactured	r 19,055	25,598
Nonferrous metals, unwrought and semimanufactured	545	942
NONMETALS		
Crude minerals and manufactures	2,876	4,574
Cement	7,575	34,713
Salt	20,495	18,354
MINERAL FUELS AND RELATED MATERIALS		
Solid, including coal, lignite, and briquets	63	79
Liquid, including crude and refined petroleum thousand 42-gallon barrels	1,258	1,205
Asphalt	6,269	4,503

r Revised.

Source: Banco Central del Paraguay, Departamento de Estudios Económicos. Boletin Estadístico Mensual. Asunción, Paraguay, No. 129, February 1969, pp. 69–71.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—Industrial, Comercial, Importadora, Exportadora, S.A. (ICIERSA), was scheduled to begin production of steel wire and allied products in early 1969. In order to protect this national industry, imports of steel wire and derivatives were temporarily suspended. The plant, imported from Germany at a reported cost of $600,000, has a capacity of 10,000 tons annually; Paraguay's annual consumption was estimated at 7,000 tons. Raw material primarily from Belgium and Yugoslavia will enter the country duty free.

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SURINAM [9]

The mining industry of Surinam in 1968 continued to be the nation's major foreign exchange earner, and contributed substantially to governmental revenues. Bauxite and related products accounted for almost all mineral production and export; small quantities of gold and construction materials were produced, and small quantities of copper, lead, iron and steel, and petroleum refinery products were reexported.

Production of bauxite increased about 2 percent, regaining its 1966 level. Reflecting plant expansion, alumina production was up 20 percent, and aluminum exports increased 40 percent, presumably as more hydroelectric power became available. Gold production also returned to its 1966 volume.

In 1967, the latest year for which data are available, Surinam's trade balance continued favorable. Mineral commodity exports were $17.2 million [10] greater in value than in 1966, an increase of 22.7 percent; again most of the increase was due to greater export of alumina and aluminum. Bauxite and alumina continued to flow in undiminished quantity to the United States and Canada, but there is evidence that some exports in the future will turn toward Western Europe, as a result of Surinam's association with the European Economic Community. Mineral commodity imports were $1.2 million greater than in 1966. Significantly increased imports included steel semimanufactures and cement, each up 23 percent, and residual fuel oil, up 32 percent. Coal imports declined 14 percent.

Comparative values of general trade and mineral commodity trade are shown in the following tabulation:

	Value (million dollars)		Mineral commodities,[1] share of (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1965	47.0	r 59.2	r 79.4
1966	75.9	r 92.5	r 82.1
1967	93.1	107.7	86.4
Imports:			
1965	16.9	r 96.0	r 17.6
1966	r 19.0	r 90.3	r 21.0
1967	20.2	103.7	19.5
Trade balance:			
1965	+30.1	r −36.8	XX
1966	+56.9	r +2.2	XX
1967	+72.9	+4.0	XX

r Revised. XX Not applicable.
[1] Does not include reexports.

[9] Prepared by F. W. Wessel.
[10] Where necessary, values have been converted from Surinam florins (S.f.) to U.S. dollars at the rate of S.f.1.00 equals US$0.53.

Table 11.—Surinam: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite, gross weight:					
Metallurgical and chemical grades thousand tons	[1] r 3,393	4,360	r 5,563	5,466	5,572
Refractory and abrasive grades	235,465	r 243,449	NA	NA	NA
Alumina, gross weight—thousand tons	-------	115	• 407	741	892
Metal [2]	-------	1,258	25,701	31,097	43,550
Columbium-tantalum ores, gross weight	NA	[3] 7	NA	NA	NA
Gold, metal—troy ounces	8,258	6,269	5,159	• 4,500	• 4,690
NONMETALS					
Clays, common	4,200	3,300	• 8,000	• 3,800	• 2,200
Stone, sand, and gravel:					
Stone, crushed and broken	9,629	13,807	• 47,000	• 104,700	65,589
Gravel	NA	34,034	• 27,000	• 8,100	NA
Sand, excluding glass sand:					
Common sand	NA	149,748	• 225,000	• 105,000	NA
Stone sand	5,725	10,423	9,600	• 14,850	4,383

• Estimated. r Revised. NA Not available.
[1] In 1964, 113,000 tons of offgrade bauxite was used for road surfacing and similar uses.
[2] Exports.
[3] U.S. imports.

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Table 12.—Surinam: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite	4,578,999	3,720,899
Oxide (alumina) and hydroxide	348,854	684,894
Metal, including alloys:		
Unwrought (domestic)	[1] 25,701	30,828
Unwrought [2 3]	13	25
Copper, metal, including alloys, unwrought [2 3]	94	106
Iron and steel:[2]		
Steel, primary forms [3]	1,462	3
Semimanufactures	48	498
Lead, metal, unwrought [2 3]	52	47
Other	1	--
NONMETALS		
Cement [2]	35	1
Sand, clay, earth	11,360	6,709
MINERAL FUELS AND RELATED MATERIALS		
Natural gas liquids: Liquefied petroleum gas	4	--
Petroleum:[2]		
Crude 42-gallon barrels	13	--
Refinery products:		
Gasoline ---do---	694	114
Kerosine ---do---	296	195
Distillate fuel oil ---do---	88	347
Lubricants ---do---	318	1,127
Other ---do---	6	77

[1] Company figure; official figure 2,884 metric tons.
[2] Reexports.
[3] Apparently includes scrap derived from imported metal and metal products.

Source: Algemeen Bureau voor de Statistiek, Suriname (Bureau of Statistics, Surinam). Maandstatistiek van de in- en uitvoer per goederensoort en per land. December (cumulative), 1966 and 1967.

Table 13.—Surinam: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum: Metal, including alloys:		
Unwrought	4	(1)
Semimanufactures	372	426
Copper: Metal, including alloys:		
Unwrought	(r)	(1)
Semimanufactures	r 91	94
Gold: Metal, unworked or partly worked ---troy ounces---	4,823	4,829
Iron and steel: Metal:		
Steel, primary forms	84	58
Semimanufactures	20,941	25,811
Lead, metal, including alloys: Semimanufactures	32	49
Magnesium, metal, including alloys: semimanufactures ---kilograms---	1,800	22,600
Mercury ---76-pound flasks---	9	64
Nickel, metal, including alloys: Semimanufactures	4	2
Tin, metal, including alloys, all forms ---long tons---	10	10
Zinc, metal, including alloys, all forms	7	5
Other, base metals, including alloys, all forms, n.e.s.	--	3

Table 13.—Surinam: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967
NONMETALS		
Abrasives, natural, n.e.s.	4	1
Asbestos	926	1,229
Cement	41,433	50,922
Chalk	291	309
Clays and clay products (including all refractory brick):		
Crude clays, n.e.s.[2]	1,385	970
Products	1,304	1,646
Diatomite, and other infusorial earths	66	105
Fertilizer materials:		
Manufactured:		
Nitrogenous	3,810	3,253
Phosphatic	64	81
Potassic	127	101
Other, including mixed	501	161
Lime	1,334	2,721
Salt	1,285	1,397
Stone, sand and gravel:		
Dimension stone, crude and partly worked	5,704	--
Gravel and crushed rock	88,063	12,758
Other	152	88
Other nonmetals, n.e.s.	2,195	19,884
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural [3]	1,322	5,184
Coal, all grades, including briquets	r 19,634	16,875
Gas, hydrocarbon: Natural gas liquids: Liquefied petroleum gas	2,911	4,135
Petroleum, refinery products:[4]		
Gasoline ---thousand 42-gallon barrels---	r 176	172
Kerosine ---do---	46	44
Distillate fuel oil ---do---	565	549
Residual fuel oil ---do---	1,571	2,078
Lubricants ---do---	21	27
Mineral jelly and wax	78	127
Other ---thousand 42-gallon barrels---	2	1
Mineral tar and other coal, petroleum or gas derived crude chemicals	173	208

r Revised.
[1] Less than ½ unit.
[2] Includes some sand and other earths.
[3] May include some refinery asphalt.
[4] Excluding LPG and refinery asphalt.

Source: Algemeen Bureau voor de Statistiek, Suriname (Bureau of Statistics, Surinam). Maandstatistiek van de in- en uitvoer per goederensoort en per land. December (cumulative), 1966 and 1967.

COMMODITY REVIEW

Metals.—*Aluminum.*—N.V. Billiton Mij. concluded additional alumina sales contracts with Phelps Dodge Corp., Swiss Aluminum, Ltd. (Alusuisse), and Aluminium Delfzijl N.V. Total quantity involved is 300,000 metric tons. Including current contracts, Phelps Dodge will purchase 160,000 tons annually, Delfzijl 170,000, and Alusuisse 100,000.

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Table 14.—Bauxite shipments from Surinam

(Metric tons)

Company and destination	1965	1966	1967	1968
Suriname Aluminum Co.:				
United States and Canada	2,645,910	2,866,797	2,018,397	2,004,748
Europe	85,271	89,924	118,751	110,575
Other	13,367	16,094	17,100	22,961
Total	2,744,548	2,972,815	2,154,248	2,138,284
N.V. Billiton Mij.:				
United States	893,734	1,080,815	1,083,588	1,056,775
Canada	705,856	548,929	618,131	579,502
Europe	20,005	31,960	3,048	9,408
Other	4,775		6,880	1,901
Total	1,624,370	1,611,704	1,711,647	1,647,586
Grand total	4,368,918	4,584,519	3,865,895	3,785,870
Apparent domestic consumption	230,000	978,000	1,600,000	1,786,000

Billiton is one-sixth owner of Delfzijl, which during 1968 increased its capacity from 32,000 tons of aluminum per year; eventual capacity will be 90,000 tons. In order to meet the increased alumina needs, Billiton will deliver an additional 600,000 metric tons of bauxite annually to the alumina plant of the Suriname Aluminum Co. (Suralco). This will presumably require the opening of Billiton's Para mine, as the reserves at Kankantrie are limited.

On the basis of a geological study, Salzgitter Industriebau G.m.b.H. reported a theoretically estimated 1 billion tons of high-grade bauxite, plus much more lower grade material, in the Bakhuys Mountains area. Another estimate, concurrently appearing, mentions 400 million tons of ore of 45 to 50 percent Al_2O_3, and "possibly as much as 2 billion tons of ore-quality reserves."[11] The ore is said to contain 20 percent iron (in comparison with 12 to 14 percent in Suralco's present plant feed).

Negotiations between the Surinam Government and (1) Reynolds Metals Co., (2) Kabalebo Joint Venture, an entity consisting of Kaiser Aluminum & Chemical Corp. and Cie. de Produits Chimiques et Electrométallurgiques Pèchiney, and (3) a consortium including Suralco, Alcan Aluminium, Ltd., Billiton, and Ormet Corp. continued during the year. In July the Government accepted an offer made by the latter consortium, issuing an exploration concession. If the consortium finds adequate ore, a mining license will be granted. The consortium will undertake to erect an alumina plant of at least 400,000 to 500,000 tons annual capacity, and to convert to alumina in Surinam from 60 to 75 percent of the bauxite mined. Estimated cost of equipping and opening the mine is $26 million, and of building the alumina plant, $60 million. Guarantees, royalties, tax levels, and power contracts are still to be worked out; negotiations are proceeding. A 200,000-ton-per-year aluminum smelter was discussed, but did not become part of the agreement.

Early in August the Government granted an exploration concession to Kabalebo Joint Venture; if enough ore is found, an exploitation grant to 500 square kilometers of the Bakhuys Mountains area will be issued. The agreement is said to include a contract for electric power.

Mineral Fuels.—*Petroleum.*—The Surinam Parliament has authorized the Government to conclude an agreement with a Royal Dutch/Shell subsidiary. Under the terms of this agreement, in addition to its present offshore concession, Shell Suriname Exploratie en Produktie Mij., N.V., will obtain a concession to 6,200 square miles of coastal plain. The area is wedge-shaped, extending across Surinam from the Courantyne River estuary to the mouth of the Marowyne River; it is about 36 miles deep along the Courantyne estuary, and about 7 miles deep at the eastern border.

Shell may explore for and produce hydrocarbons in this area for 40 years, with options for extension. In return, Shell is to pay a bonus of S.f. 1 million upon signing of the agreement, to pay income

[11] Metals Week. Aluminum. V. 39, No. 10, Mar. 18, 1968, pp. 6–7.

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tax at a 50-percent rate, to pay a royalty of 12½ percent of wellhead value of crude oil produced, and to pay surface rents on a graduated scale from S.f. 80,000 per year at the beginning to S.f. 6.4 million annually in the 13th year and thereafter. Moreover, the Surinam Government has the option, during the first 4 years of the concession, to buy a one-third interest upon payment of one-fourth of the exploration and development costs to date.

URUGUAY [12]

The inflationary spiral, a slowdown in commerce, and tight money did little to encourage mining in Uruguay. Except for construction materials, chiefly for local use, production decreased in nearly all commodities.

The Government took steps to encourage foreign investment in the mineral industry by calling for bids on offshore areas for oil exploration, and in encouraging the development of heavy mineral beach sands primarily containing ilmenite.

Administración Nacional de Combustibles, Alcohol y Portland (ANCAP), a government entity, showed a gain of 23 percent in cement production over that of 1967, but output of petroleum refinery products decreased.

No new mineral enterprises were announced, but reports of gold and uranium discoveries led to some hope of useful production.

In 1968 the regulation requiring that mining producers be properly registered

[12] Prepared by Burton E. Ashley.

Table 15.—Uruguay: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum: Metal:					
Secondary	150	150	305	250	250
Semimanufactures	1,500	1,035	1,126	1,750	1,400
Iron and steel:					
Iron ore (for cement)	1,667	e 1,700	e 1,900	e 2,000	2,200
Steel, crude [1]	14,327	13,476	r 10,365	13,550	8,500
Steel, semimanufactures	e 39,000	36,300	36,000	37,300	32,566
NONMETALS					
Cement:					
Hydraulic	402,214	422,680	469,272	415,726	515,431
Masonry	9,950	8,758	8,871	4,878	8,307
Clays:					
Refractory	484	4,679	8,270	r 1,933	10,311
Other	36,000	48,418	54,732	55,044	56,205
Feldspar	897	1,247	1,750	1,262	441
Gem stones, semiprecious (exports)	103	54	58	60	96
Quartz	1,256	292	525	349	143
Stone, sand and gravel:					
Dimension stone	2,208	7,164	6,928	5,536	13,121
Crushed and broken:					
Limestone and other calcareous	777,331	766,922	799,609	741,556	834,759
Other	405,944	261,364	220,568	298,615	494,567
Gravel	47,447	113,776	72,813	106,989	150,255
Sand	477,140	691,519	763,310	749,848	1,343,113
Sulfate, natural	35	114	288	293	334
Sulfur [2]	------	------	------	50	e 80
Talc, ground	2,124	2,375	2,128	2,638	2,208
MINERAL FUELS AND RELATED MATERIALS					
Coke, gashouse	20,850	19,563	20,979	21,282	19,658
Gas, manufactured—million cubic feet	1,059	NA	NA	970	934
Petroleum: Refinery products:					
Gasoline and naphtha—thousand 42-gallon barrels	2,385	2,306	2,322	2,343	2,041
Kerosine and jet fuel—do	1,616	1,390	1,433	1,440	1,255
Distillate fuel oil—do	2,330	2,220	2,262	2,270	2,024
Residual fuel oil—do	4,367	4,974	4,785	4,792	4,077
Liquefied petroleum gas—do	183	203	239	236	216
Asphalt—do	61	113	112	69	112
Other—do	63	29	31	276	28

e Estimate. p Preliminary. r Revised. NA Not available.

[1] Instituto Latinoamericano del Fierro y el Acero. Departamento de Estudios Económicos. Anuario Estadístico. 1968, table 9.

[2] Recovered from refinery gases.

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was strengthened and enforced. As a resu't, it was possible to list mining companies operating within the country. The present list, which was considered complete, contains about 25 names of different firms; products were nearly entirely in the field of nonmetallic construction materials. Three firms were listed as producers of galena, iron ore, and graphite.

Chief mineral imports, by value, were crude oil and some refinery products, iron and steel products, and copper. Exports were largely limited to construction materials mostly destined for Argentina.

The following tabulation compares mineral trade with total commodity trade for the years 1965–67:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	1.0	191.2
1966	2.7	186.0
1967	1.5	158.7
Imports:		
1965	35.1	150.7
1966	41.9	164.0
1967	46.9	171.4

Table 16.—Uruguay: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
Cement	51,872	47,151
Precious and semiprecious stone, except diamond--kilograms	68,911	63,311
Stone, sand and gravel:		
Dimension stone	2,347	3,031
Dolomite	15,071	25,429
Gravel and crushed rock	r 162,836	200,224
Sand	517,930	656,810
Talc	r 30	-------

r Revised.

Metals.—*Gold.*—The Uruguay Geological Institute announced a gold discovery in Treinta y Tres Province, some 250 miles north of Montevideo. No details were given, except that the discovery was described as a "fair sized deposit."

Iron and Steel.—Industria Nacional Laminadora (Inlasa) received government permission to import a bar and rod rolling mill with capacity of 80,000 tons annually. Uruguay reportedly wishes to establish an integrated iron and steel facility. To that end, site preparation on the Bay of Montevideo for a blast furnace was planned.

Iron ore will come from the Valentines deposit and will be produced by Yacimientos Mineros de Valentines, S.A. (YMVSA). A pelletizing plant to produce about 750,000 tons annually was planned at the mine site.

The Valentines deposit is located 261 kilometers north of Montevideo. It has been described as an itabirite type of iron ore occurrence, with reserves calculated at 30 million tons. Average grade is 38 to 40 percent iron with less than 0.01 percent sulfur and less than 0.05 percent phosphorus.

Open-pit mining is feasible, and rail transportation to Montevideo presents few problems.

Mineral Beach Sands.—ANCAP[18] released a report dated January 1969 on the mineral beach sands lying along the Atlantic coast at Aguas Dulces, some 280 kilometers northeast of Montevideo. ANCAP has drilled 450 test holes to an average depth of 6 meters, presumably over the entire 12-kilometer length of prospective beach. It is estimated that the area contains 3 million metric tons of heavy minerals with a heavy mineral concentration of 2.5 percent. Heavy mineral composition was reported as ilmenite, 60 percent; zircon, 5 percent; rutile, 1 percent; and monazite, 0.6 percent. The report suggests that annual production of 70,000 tons of heavy minerals would account for 41,000 tons of ilmenite, 3,400 tons of zircon, 680 tons of rutile, and 400 tons of monazite. Operations on this scale should give a mine-life of 40 years.

A Presidential decree authorized the formation of a mixed Uruguayan-foreign company to exploit the sands for commercial purposes. Any company interested in the undertaking would likely deal directly with ANCAP.

Uranium.—Preliminary samples assaying 500 grams of uranium per ton were reported from a discovery in the Cerro Largo area. Appraisal of the deposit was to be continued.

Nonmetals.—*Fertilizer Materials.*—Albatros' Superfosfaatfabrieken N.V., a Netherlands firm, received authorization from the Uruguay Government to proceed with its

[18] Administración Nacional de Combustibles, Alcohol y Portland. Montevideo, January 1969, Memorandum: Industrialización de las Arenas Negras Uruguayas.

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Table 17.—Uruguay: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Bauxite	1,005	1,801
Oxide (alumina) and hydroxide	396	880
Metal, unalloyed, unwrought and semimanufactured	1,496	1,340
Antimony, metal, unalloyed, unwrought	11	4
Arsenic, white	61	79
Copper, metal, unalloyed, unwrought and semimanufactured	628	866
Iron and steel:		
Ore and concentrate	17	6
Metals:		
Scrap	52	94
Ferroalloys	156	248
Pig iron, and ingot steel	34,872	23,842
Powder	10	------
Semimanufactures	47,622	41,856
Lead:		
Oxides	231	389
Metal, unalloyed, unwrought	821	1,110
Manganese, oxides	17	18
Mercury----76-pound flasks	23	11
Nickel, metal, including alloys	4	6
Silver, metal, including alloys troy ounces	868	482
Tin, metal, unwrought, including alloys----long tons	31	29
Zinc:		
Lithopone	254	274
Metal, unalloyed, unwrought and semimanufactures	1,053	881
Other, metals not further designated	30	29
NONMETALS		
Abrasives, natural, n.e.s	81	125
Alums	11	(1)
Arsenic	61	79
Asbestos	1,381	1,094
Barite and witherite	33	24
Boron materials, oxide and acid	42	36
Cement	47	30
NONMETALS—Continued		
Clays and clay products (including all refractory brick):		
Crude clays:		
Bentonite	42	31
Kaolin (china clay)	1,614	1,644
Products: Refractory brick and similar products	r 283	892
Cryolite	2	8
Diatomite, and other infusorial earths	305	310
Feldspar	1	1
Fertilizer materials: Manufactured:		
Nitrogenous	8,484	1,350
Phosphatic	r 88,725	80,474
Fluorspar	185	100
Graphite, natural	3	7
Gypsum and plaster	19,433	19,595
Mica	2	2
Salt	r 50,936	50,867
Sodium and potassium compounds	14,752	10,684
Sulfur	9,420	10,212
MINERAL FUELS AND RELATED MATERIALS		
Asphalt and bitumen, natural	34	27
Carbon black	1,530	1,053
Coal, all grades, including briquets	14,235	18,061
Coke and semicoke	1,952	2,150
Petroleum:		
Crude thousand 42-gallon barrels	r 13,372	11,042
Refinery products:		
Gasoline thousand 42-gallon barrels	19	87
Kerosine----do	57	87
Distillate fuel oil----do	75	71
Residual fuel oil----do	676	114
Lubricants----do	r 82	77
Mineral jelly and wax----do	554	386
Other----do	77	1,145
Mineral tar and other coal, petroleum or gas derived crude chemicals	7	45

r Revised.
1 Less than ½ unit.

Source: Banco de la República Oriental del Uruguay, Departamento de Investigaciones Económicas Importaciones Cumplidas. 1966 and 1967, Cuadro 27.

plans to produce fertilizers in the country. A plant site was acquired west of Montevideo on the Plate River.

Alternatives were being evaluated regarding investment level, product mix, and possible sources of materials to be imported.

Mineral Fuels.—*Petroleum.*—Early in the year, Uruguay invited firms to bid on offshore leases for oil along most of the country's coast. As ANCAP, the Government petroleum organization, alone has the rights to explore for petroleum, any successful bidder would have to make contracts with that body. About 80,000 square kilometers are open to bidding.

General terms required by contracts were suggested and covered the amount of time to be allowed for prospecting, reduction of lease area as prospecting progresses, and division of profits with ANCAP. The division of profits was not firmly fixed, but will presumably be negotiated after production is found.

At yearend, five firms had bid to supply up to 1 million cubic meters (6 million barrels) of crude oil to be delivered to the ANCAP refinery over a period of 4 years; supply for a fifth year was optional. ANCAP also called for a financial assistance loan of $7 million from the successful bidder.

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The Mineral Industry of Other European Countries

By Joseph B. Huvos [1] Bernadette Michalski [1] and Roman Sondermayer [1]

CONTENTS

	Page		Page
Albania	873	Iceland	881
Denmark (including Greenland)	874	Switzerland	882

ALBANIA

The Albanian minerals industry produced in 1968 chromite, copper, iron-nickel ore, cement, lignite, petroleum, bitumen, and fertilizers. While actual production figures were not available for 1968, it was reported that production goals were exceeded for most mineral products.

Aid by mainland China was significant in the Albanian economy. Credits by mainland China were estimated to be about 18 percent of Albania's national income in 1968. The Elbasan ironworks and the Cerrik petroleum refinery were the major projects made possible by this aid.

[1] Foreign mineral specialist, Division of International Activities.

Table 1.—Albania: Production of selected mineral commodities

(Metric tons unless otherwise specified)

	1964	1965	1966	1967	1968 p
METALS					
Chromite	r 306,822	r 310,773	r 301,674	r 326,872	NA
Copper:					
Ore, gross weight	r 144,673	r 219,988	r 228,136	r 267,245	NA
Blister	2,204	4,167	r 4,831	r 4,831	6,000
Iron-nickel ore	r 350,741	r 395,713	r 395,713	r 404,507	NA
NONMETALS					
Cement	r 127,161	r 134,061	r 138,560	r 220,436	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal (lignite)	r 291,626	r 331,161	r 392,747	r 434,419	NA
Petroleum:					
Crude	r 763,723	r 825,245	r 890,396	r 988,123	NA
Refinery products:					
Gasoline	r 52,255	r 44,467	r 43,478	44,961	NA
Gas oil	r 80,467	r 78,225	r 95,735	r 104,905	NA
Diesel oil	r 2,339	NA	NA	NA	NA
Other	r 341,068	r 384,463	r 449,087	r 539,865	NA
Total	r 476,129	r 507,155	r 588,300	r 689,731	NA
Electric power—thousand kilowatt hours	r 288,299	r 341,271	r 432,401	r 587,693	NA

r Revised. p Preliminary. NA Not available

Source: Vjetari Statistikor iR.P.Sh. 1967 dhe 1968 (Statistical Yearbook of the Peoples Republic of Albania for 1967–68). Tirana, Albania, 151 pp. Production figures for 1965–66 were compiled by using the 1960 production figures and the rate of growth figures given for each year respectively.

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Table 2.—Albania: Trade of selected mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity		1966	1967
EXPORTS			
METALS			
Chromite		309	323
Copper, blister	tons	2,214	2,032
Cathods	do	300	775
Iron-nickel ore		373	392
NONMETALS			
Bitumen (natural asphalt)		23	27
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude		253	166
Bituminous flux		248	333
IMPORTS			
METALS			
Iron and steel:			
Pig iron		4	4
Steel, ingots		7	10
Semimanufactures:			
Pipe		13	26
Other		24	41
Total		37	67
Zinc oxide	tons	144	120
NONMETALS			
Cement		22	17
Fertilizers, manufactured		30	67
Sulfuric acid	tons	2,055	468
MINERAL FUELS AND RELATED MATERIALS			
Coke		24	26

Source: Vietari Statistikor i R.P.Sh. 1967 dhe 1968 (Statistical Yearbook of the Peoples Republic of Albania for 1967–68) Tirana, Albania, 151 pp.

TRADE

Trade statistics for the years 1966–67 show that exports increased moderately for most commodities, except for blister copper and petroleum. Blister copper export decreased in favor of copper cathodes and the export of crude oil also decreased in favor of refined products, mainly bituminous flux. Albanian chromium ore is exported normally to OECD (Organization for Economic Co-Operation and Development) countries. A trade agreement signed with France provides for imports of sheet metal, construction steel, and equipment for the petroleum and the metallurgical industry, in exchange for agricultural products. A trade agreement signed with Austria provides for the export of 100,000 tons of iron-nickel ore, 10,000 tons of chromium ores, and smaller quantities of blister and cathode copper. The import of $100,000 worth of mining equipment is also part of the deal.

COMMODITY REVIEW

Metals.—Production of chromite reportedly exceeded goals set in 1968 for the Batër-Martanesh mine and the Fitorjë chromium enterprise. New ore reserves were discovered at the deposits of Bulqizë, Batër, Thekna, Lugje, and Gjat; new deposits were found in Bulqizë, Tropojë, and Sebenik. The production of the Gjegjan copper mines and the Rubjik smelter exceeded production goals set for 1968. Construction was started on a copper ore concentrator in the Bulqizë mining center, with the assistance of mainland China.

A special treaty was signed in Peking at yearend obtaining mainland China's assistance in building a new ironworks at Elbasan, which will employ 8,000 workers. In the new Elbasan ferroalloy works 800,000 tons of ferronickel will be processed each year.

Nonmetals.—The year 1968 marked the beginning of cement exports from Albania, as production exceeded demand for the first time.

Mineral Fuels.—New coal deposits have been found in the districts of Krrabë, Memaliaj, Manzi, and Mborje-Drenove and at Valas, where a plus 210,000-ton-per-year mine was being developed, with the help of mainland China. A coal-washing plant was being built at Tirana, also with the help of mainland China.

In September 1968 the Cerrik petroleum refinery was commissioned, designed, and equipped by mainland China and built and operated by Albanians. The refinery is designed for a capacity of 1 million tons of petroleum products per year.

Power.—The Fier thermal powerplant with a designed capacity of 100 megawatts was under construction and will be commissioned in 1969.

DENMARK (INCLUDING GREENLAND)

DENMARK

As in past years, Denmark remained a modest producer of mineral commodities during 1968. Nonmetallic construction materials, lignite, and bog iron ore were produced from domestic mineral resources while the production of manufactured fertilizers and petroleum refinery products

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was based on imported raw materials. The output of the latter two groups of commodities (about 800,000 metric tons of fertilizers and 50 million barrels of petroleum refinery products) constituted the largest proportion of the country's mineral production by a wide margin.

The mineral industry contributed only about 1 percent to Denmark's gross national product (GNP) during 1968 and employed about 3,500 persons. Foreign trade statistics for minerals and related commodities for 1967, the most recent year for which complete data are available, indicated a 4.3-percent growth in mineral commodity exports, and a 2.2-percent growth in mineral commodity imports, by value, as shown in the following tabulation:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1966	92.8	2,401.9	3.9
1967	96.8	2,473.8	3.9
Imports:			
1966	658.2	2,990.0	22.0
1967	673.2	3,133.9	21.5
Trade balance:			
1966	—565.4	—588.1	XX
1967	—576.4	—660.1	XX

XX Not applicable.

The principal importers of Denmark's mineral commodities, expressed in dollar values, were Sweden—$29.2 million; West Germany—$19.4 million; and Norway—$17.5 million.

Table 3.—Denmark: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Iron and steel:					
Iron ore (less than 42 percent iron)--thousand tons--	90	65	55	57	•55
Pig iron--do--	72	75	82	75	75
Steel ingots and castings--do--	396	412	405	397	419
Steel semimanufactures--do--	347	360	•373	•410	452
Lead, primary	9,000	10,600	10,100	9,900	9,700
NONMETALS					
Cement, hydraulic--thousand tons--	1,898	2,000	2,100	2,200	2,070
Chalk	•35,000	•35,000	32,000	35,000	•34,000
Clays: Kaolin:					
Crude	8,000	6,847	15,000	15,000	•15,000
Washed	NA	2,500	3,000	3,000	•3,000
Diatomaceous materials:					
Diatomite--thousand tons--	19	13	10	20	NA
Moler--do--	191	213	203	200	NA
Fertilizers:					
Manufactured: Phosphatic, other, P_2O_5 content	43,205	43,496	50,000	r 55,000	65,000
Mixed, and unspecified, gross weight	716,760	756,513	715,500	•715,000	•713,000
Limes:					
Quicklime	159,284	162,667	150,000	190,000	•190,000
Agricultural	370,000	410,000	275,000	290,000	•280,000
Salt	-------	-------	25,000	100,000	150,000
Stone, sand and gravel:					
Dimension stone, granite:					
Total quarry production	914,437	699,692	•700,000	NA	NA
Dimension stone, rough and finished	38,235	34,113	NA	NA	NA
Crushed and broken limestone and other calcareous thousand tons--	NA	NA	3,500	NA	NA
Gravel--thousand cubic meters--	3,600	4,200	5,300	5,000	NA
MINERAL FUELS AND RELATED MATERIALS					
Coal, lignite only--thousand tons--	2,195	2,128	1,982	•1,900	•700
Coke, all types--do--	424	329	317	268	221
Fuel briquets, lignite briquets only--do--	66	24	50	27	22
Petroleum refinery products:					
Gasoline, all kinds--thousand 42-gallon barrels--	4,993	5,719	6,529	9,453	9,578
Kerosine and jet fuel--do--	430	646	916	966	1,467
Distillate fuel oil--do--	5,405	6,899	8,501	13,250	14,195
Residual fuel oil--do--	9,678	11,380	14,876	19,502	21,761
Liquefied petroleum gases--do--	951	1,083	1,280	1,582	1,715
Lubricants including greases--do--	7	NA	NA	NA	NA
Bitumen--do--	157	160	280	399	647
Other--do--	1,379	2,159	2,805	2,613	702
Total--do--	28,000	28,046	35,187	47,765	50,065
Refinery fuel and losses--do--	718	489	664	NA	NA

• Estimate. p Preliminary. r Revised. NA Not available.

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The principal sources of mineral commodities imported by Denmark were West Germany—$106.8 million; United Kingdom—$91.6 million; Sweden—$65.9 million; and Norway—$45.4 million.

Table 4.—Denmark: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Oxide and hydroxide [1]	85	114	United Kingdom 72; New Zealand 15.
Metal, including alloys:			
Unwrought, including scrap	3,758	1,854	Sweden 1,132; Belgium-Luxembourg 421.
Semimanufactures	1,169	1,496	Sweden 338; West Germany 169.
Antimony, metal, including alloys	6	15	Trinidad and Tobago 7.
Chromium, metal, including alloys	25	-------	
Copper, metal, including alloys:			
Scrap	3,548	4,381	West Germany 2,132; Belgium-Luxembourg 1,796.
Unwrought	766	494	West Germany 184; Sweden 139.
Semimanufactures	1,878	2,026	United Kingdom 545; West Germany 305; Sweden 245.
Iron and steel:			
Ore and concentrate	26,169	27,607	West Germany 11,461; United Kingdom 9,046.
Roasted pyrite	88,188	83,290	West Germany 61,863.
Metal:			
Pig iron, ferroalloys and similar materials.[2]	39,878	63,159	Sweden 24,146; Norway 15,722.
Steel, primary forms	3,136	2,446	Norway 2,345.
Semimanufactures:			
Bars, rods, angles, shapes, sections.	31,820	58,609	West Germany 30,206; United Kingdom 11,108.
Universals, plates and sheets	105,462	109,371	Sweden 47,177; Norway 27,465.
Tubes, pipes, and fittings	9,115	9,678	Sweden 4,541; Poland 1,196.
Castings and forgings, rough	4,692	3,300	Sweden 1,397.
Other	546	27,986	West Germany 25,426.
Total semimanufactures	151,635	208,944	
Lead, metal, including scrap:			
Unwrought, including scrap	5,735	5,677	Norway 2,781.
Semimanufactures	146	40	Greece 8; Norway 7; Ethiopia 7.
Magnesium metal, including alloys, all forms	53	48	United States 43; West Germany 5.
Manganese oxides	110	262	NA.
Nickel metal, including alloys, scrap and semimanufactures.	428	249	United Kingdom 64; West Germany 61.
Silver:			
Waste and sweepings, value, thousands	$1,275	$1,415	United Kingdom $480; West Germany $470.
Metal, including alloys, semimanufactures, do	$81	$149	West Germany $54; United Kingdom $47.
Tin metal, including alloys:			
Unwrought, including scrap, long tons	824	1,077	Hungary 250; Italy 124.
Semimanufactures, do	27	49	Sweden 38.
Titanium dioxide	48	158	United Kingdom 53; Iran 30.
Zinc:			
Oxide	-------	20	West Germany 11; Iceland 8.
Metal, including alloys:			
Scrap, including blue powder (dust)	2,096	3,261	West Germany 1,416; Norway 511.
Unwrought and semimanufactures	402	455	Netherlands 69; Norway 43.
Other:			
Ash and residue containing nonferrous metals.	5,010	4,359	Belgium-Luxembourg 1,509.
Oxides, hydroxides and peroxides of metals, n.e.s.	15	10	Iran 7.
Base metals, including alloys, all forms, n.e.s.	r 29	20	West Germany 17.
NONMETALS			
Cement	202,830	111,338	Sweden 20,165; Australia 5,147.
Chalk	23,347	23,884	West Germany 9,009; Norway 2,575.
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s	3,658	4,347	Finland 2,589; Sweden 1,447.
Products:			
Refractory [3]	50,375	43,776	United Kingdom 9,101; West Germany 6,039.
Nonrefractory	142,067	123,866	West Germany 85,507; Norway 24,611.

See footnotes at end of table.

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Table 4.—Denmark: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
NONMETALS—Continued			
Cryolite and chiolite	• 26,500	28,291	NA.
Diamond:			
Gem, not set or strung value, thousands	$27	$44	Belgium-Luxembourg $32; Sweden $9.
Industrial	NA	$6	All to Sweden.
Diatomite and other infusorial earths	102,399	106,321	West Germany 50,536; United Kingdom 42,320.
Fertilizer materials (manufactured, all types)	62,747	17,813	Poland 10,060.
Lime	20,051	25,866	Sweden 13,610; Norway 10,644.
Pigments, mineral, including processed iron oxide.	75	80	Finland 29; Costa Rica 18.
Salt	13,435	13,008	Sweden 7,325; Norway 3,334.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	79,111	NA	NA.
Worked	2,125	2,100	Norway 1,194; Sweden 576.
Gravel and crushed rock_thousand tons	2,128	1,899	West Germany 1,859.
Limestone (except dimension)	77,722	101,145	Sweden 51,355; West Germany 36,784.
Quartz and quartzite	14,480	10,853	West Germany 10,815.
Sand, except metal bearing	137,891	129,360	Sweden 102,268.
Sulfuric acid	2,328	125	All to Iceland.
Other nonmetals, n.e.s	1,564	2,351	West Germany 1,251; Sweden 694.
Slag, dross and similar waste, not metal-bearing:			
From iron and steel manufacture	7,400	5,254	All to West Germany.
Slag and ash, n.e.s	81,778	64,464	Do.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,576	1,042	Finaland 799; Iceland 187.
Carbon black	87	120	Norway 48; Sweden 41.
Coke and semicoke	50,695	72,807	Sweden 29,112; Norway 28,752.
Gas, hydrocarbon, liquefied_thousand tons	10	17	Sweden 6; United Kingdom 4.
Peat, including peat briquets and litter	6,823	4,661	West Germany 3,134; United States 910.
Petroleum, refinery products:			
Gasoline_thousand tons	326	292	Sweden 239; Norway 27.
Kerosine and jet fuel_do	25	14	Norway 9; Sweden 4.
Distillate fuel oil_do	338	372	Sweden 358.
Residual fuel oil_do	33	113	Sweden 54; Unitd Kingdom 37.
Lubricants_do	18	17	Norway 13; Sweden 2.
Other_do	3	16	Norway 8.
Mineral tar and other coal, petroleum or gas derived crude chemicals.	10,546	18,693	Netherlands 16,782.

• Estimate. ᵣ Revised. NA Not available.
[1] Including synthetic corundum.
[2] Including spiegeleisen and grit, sponge, or powder of iron or steel.
[3] Including those of magnesite, diatomite and other refractory materials.

Table 5.—Denmark: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Oxide and hydroxide [1]	1,836	2,471	United Kingdom 1,955; Sweden 1,428.
Metal, including alloys:			
Scrap	1,091	613	Sweden 402; Norway 170.
Unwrought	6,281	9,073	Norway 6,206; Canada 1,631.
Semimanufactures	14,699	17,091	Sweden 3,310; West Germany 2,637; Switzerland 2,497.
Antimony, metal including alloys, all forms	148	120	Mainland China 105.
Cadmium, metal including alloys, all forms	15	21	Belgium-Luxembourg 12.
Chromium, oxide and hydroxide	380	441	United Kingdom 126; France 107.
Cobalt, metal including alloys, all forms	20	22	Belgium-Luxembourg 15.
Copper: Metal, including alloys:			
Unwrought, including scrap	4,400	4,172	Belgium-Luxembourg 1,864; West Germany 1,412.
Semimanufactures	21,183	22,578	Sweden 8,355; West Germany 4,982.

See footnotes at end of table.

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Table 5.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Iron and steel:			
Ore and concentrate	1,932	1,234	Sweden 964; Norway 250.
Roasted pyrite	10,261	6,403	Norway 6,103.
Metal:			
Scrap	592	603	Sweden 503.
Pig iron, including cast iron [2]	95,673	82,805	U.S.S.R. 11,295; East Germany 9,453.
Ferroalloys	9,165	9,697	Norway 8,412.
Steel, primary forms	49,732	91,788	Norway 49,151; Sweden 15,419.
Semimanufactures:			
Bars, rods, angles, shapes, sections.[3]	332,489	347,429	Belgium-Luxembourg 55,826; Sweden 39,636.
Universals, plates and sheets	445,351	460,550	West Germany 112,076; Sweden 82,995.
Hoop and strip	64,236	62,925	Belgium-Luxembourg 29,697; West Germany 16,489.
Rails and accessories	18,191	21,583	France 10,810; Sweden 5,103.
Wire	10,102	9,543	West Germany 2,893; Belgium-Luxembourg 3,948.
Tubes, pipes, fittings	119,468	137,726	West Germany 62,414; United Kingdom 15,404.
Castings	151	87	Italy 53; West Germany 21.
Total semimanufactures	989,988	1,039,843	
Lead:			
Oxides	1,249	961	West Germany 370; Sweden 221.
Metal, including alloys:			
Scrap	5,797	7,950	Norway 3,345; Hungary 2,610.
Unwrought	14,350	11,348	Sweden 4,815; Australia 2,347.
Semimanufactures	534	631	West Germany 335; United Kingdom 116.
Magnesium metal, including alloys, all forms	88	159	Norway 127; Italy 14.
Manganese:			
Ore and concentrate	8,183	8,654	Mainland China 2,231; India 2,050.
Oxides	1,724	1,566	Japan 720; Netherlands 391.
Mercury, 76-pound flasks	609	522	Italy 204; Sweden 145.
Molybdenum metal, including alloys, all forms. kilograms	1,000	2,000	United States 1,000.
Nickel:			
Ore and matte	41	26	United Kingdom 16; United States 10.
Metal, including alloys:			
Unwrought, including scrap	85	73	United States 67.
Semimanufactures	805	527	United Kingdom 150; Sweden 132.
Platinum-group metals and silver, including alloys all forms:			
Platinum-group, value, thousands	$370	$408	NA.
Silver, do	$4,797	$5,404	United States $2,279; West Germany $1,804.
Tin, metal, including alloys:			
Scrap, long tons	93	311	Australia 162; Netherlands 56.
Unwrought, do	1,042	1,096	Thailand 250; mainland China 245.
Semimanufactures, do	95	93	United Kingdom 60.
Titanium, oxides	5,949	5,954	United Kingdom 1,575; Norway 1,366.
Tungsten metal, including alloys, kilograms	7,000	2,000	Sweden 1,500.
Zinc:			
Oxide	1,556	1,696	West Germany 745; Belgium-Luxembourg 255.
Metal, including alloys:			
Blue powder, including scrap	458	309	Norway 236; United Kingdom 60.
Unwrought	9,869	7,757	Norway 2,592; Netherlands 1,779.
Semimanufactures	6,256	7,418	Poland 2,481; Belgium-Luxembourg 2,375.
Other:			
Ore and concentrate of base metals, n.e.s.	23	19	Finland 5.
Ash and residue containing nonferrous metals.	2,467	1,021	Sweden 669; West Germany 196.
Metals, including pyrophoric alloys.	5	5	United States 2; Austria 2.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	5,027	5,559	West Germany 1,783; Italy 3,199.
Dust and powder of precious and semiprecious stones including synthetic. value, thousands	$24	$24	Belgium-Luxembourg $19.
Asbestos	20,768	23,493	Canada 9,880; Republic of South Africa 5,001.

See footnotes at end of table.

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Table 5.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Barite and witherite	1,140	1,948	West Germany 722; Italy 600.
Boron materials:			
Crude natural borates	1,313	1,260	United States 808; Turkey 400.
Oxides and acid	103	120	France 63; United States 28.
Cement	2,327	3,170	West Germany 1,609.
Chalk	633	697	West Germany 263; Sweden 96.
Clay and clay products (including all refractory brick):			
Crude clays, kaolin and other clays	72,228	61,218	United Kingdom 41,055; Czechoslovakia 10,252.
Products:			
Refractory (including nonclay bricks).	27,777	29,684	West Germany 10,316; Austria 5,574.
Nonrefractory	33,915	47,786	West Germany 23,045; Sweden 7,339.
Diamond, gem, not set or strung. value, thousands	$1,353	$1,353	Belgium-Luxembourg $542; Switzerland $348.
Diatomite and other infusorial earths	2,390	2,531	United States 2,058.
Feldspar	6,255	4,817	Norway 4,135.
Fertilizer materials:			
Crude:			
Sodium nitrate	18,275	13,820	All from Chile.
Phosphate rock	306,000	280,859	Morocco 204,715; U.S.S.R. 41,402.
Potash salts	700	1,021	All from West Germany.
Manufactured:			
Nitrogenous	450,358	323,255	Norway 271,940.
Phosphatic, including Thomas slag	42,964	24,172	Netherlands 12,722; West Germany 6,078.
Potassic	222,081	245,423	West Germany 167,789; East Germany 37,989.
Fluorspar	r 1,695	1,704	West Germany 717; mainland China 537.
Graphite, natural	410	288	Norway 128; West Germany 116.
Gypsum and plasters	95,617	108,683	Poland 98,046; West Germany 9,401.
Lime	1,827	1,320	West Germany 1,119; United Kingdom 181.
Magnesite	5,554	4,127	Austria 2,155; mainland China 903.
Mica:			
Crude, including splittings and waste	305	34[illegible]	Norway 108; Mozambique 89.
Worked, including agglomerated splittings.	51	63	West Germany 43.
Pigments, mineral:			
Natural, crude	324	294	Cyprus 136; West Germany 101.
Iron oxides, processed	3,197	4,234	West Germany 3,677.
Precious and semi-precious stone, except diamond. value, thousands	$502	$606	Japan $331; Switzerland $196.
Pyrite	130,161	113,363	Spain 80,668; Norway 32,694.
Salt	241,356	148,763	West Germany 88,315.
Stone, sand, and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous (including marble)	r 12,087	11,705	Sweden 6,880; Norway 2,269.
Slate	9,557	11,333	Norway 6,804; Sweden 2,911.
Other (granite, gneiss, etc.)	41,259	38,326	Sweden 34,069.
Worked, all types	28,696	28,377	Sweden 13,247; Portugal 10,122.
Dolomite, chiefly refractory grade	19,596	21,594	Norway 13,167; West Germany 3,068.
Gravel and crushed rock	272,699	380,514	Sweden 307,183; Norway 65,045.
Limestone (except dimension)	36,277	45,604	Sweden 36,979; Poland 4,927.
Quartz and quartzite	29,550	25,329	Sweden 21,537; Norway 3,267.
Sand, excluding metal bearing	80,146	79,859	Belgium-Luxembourg 56,436; Sweden 15,565.
Sulfur:			
Elemental, all forms	10,404	6,478	West Germany 2,053; United States 2,033.
Sulfur dioxide and sulfuric acid	8,503	9,552	Sweden 3,787; Norway 2,947.
Talc, steatite, soapstone, and pyrophyllite	13,755	14,061	Norway 10,310; Sweden 2,465.
Other nonmetals, n.e.s	18,518	24,733	West Germany 19,261; Sweden 3,425.
Slag, dross and similar waste, not metal bearing.	26,655	23,495	United Kingdom 20,951.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	1,430	1,407	United States 1,079.
Carbon black	2,037	2,335	United Kingdom 1,000; West Germany 473.
Coal and briquets:			
Anthracite and bituminous coal, including briquets. thousand tons	3,681	3,631	Poland 3,046.
Lignite and lignite briquets	135,639	105,506	East Germany 105,311.

See footnotes at end of table.

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Table 5.—Denmark: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
MINERAL FUELS AND RELATED MATERIALS —Continued			
Coke and semicoke thousand tons	832	596	West Germany 298; U.S.S.R. 155.
Gas, hydrocarbon, liquefied do	92	78	West Germany 70.
Peat, including peat briquets and litter	8,184	8,881	Sweden 7,113.
Petroleum:			
Crude and partly refined. thousand tons	4,671	6,485	Kuwait 1,837; Libya 1,685; Saudi Arabia 781.
Refinery products:			
Gasoline do	1,092	797	United Kingdom 271; Bahrain 110.
Kerosine and jet fuel do	422	416	Italy 89; Netherlands 39.
Distillate fuel oil do	3,287	2,746	United Kingdom 987; Italy 370.
Residual fuel oil do	2,740	2,195	United Kingdom 924; U.S.S.R. 514.
Lubricants do	95	91	United Kingdom 40; Netherlands 9.
Other bituminous mixtures n.e.s. do	228	240	West Germany 73; Netherlands Antilles 68.
Total do	r 7,864	6,485	

r Revised. NA Not available.
[1] Not including synthetic corundum.
[2] Including spiegeleisen, grit, sponge and powder of iron and steel.
[3] Including wire rod.

There were few significant developments in the mineral industry of Denmark during 1968. Although there was no domestic production of crude oil, the petroleum industry (exploration and refining) remained the focal point of the mineral industry. The Dansk Underground Consortium (DUC), which holds a concession covering Denmark and its Continental Shelf, abandoned three nonproductive offshore wells. The wells were drilled by a self-elevating offshore drilling rig capable of drilling up to 16,000 feet. DUC is owned by A. P. Moeller (40 percent) and Shell, Gulf, and Amoseas (60 percent).

Three petroleum refineries, with a total capacity of 168,000 barrels per day, were operational in Denmark during 1968. After the expansion of the Gulf refinery at Stigsnaes was completed in 1968, it became the largest petroleum refinery in the country with a capacity of 70,000 barrels per day.

Two corporations operated five plants with 18 rotary, wet kilns for the production of cement. During 1968, expansion was underway which should raise the country's cement capacity to 2.6 million tons per year.

GREENLAND

Greenland, Denmark's largest overseas possession, had no significant mineral production during 1968. Some output of cryolite (67,000 tons) and marble, monumental stone, and coal (27,000 tons) was recorded. However, various groups were active in mineral exploration and land acquisition during the year, generally on the western coast.

The fact that a part of Greenland apparently has geological characteristics similar to the oilfields of the Canadian Arctic has created interest on the part of some oil companies. About 13 companies have applied for concessions. The Ponderay Polar Co., a Danish registered firm, acquired exploration rights for all territory north of latitude 74° north. United States and Canadian interests are apparently involved in the capitalization of the Ponderay Polar Co. Tenneco Oil and Compagnie Française de Pétroles were the two largest companies interested in exploring for oil on the Continental Shelf off the Greenland west coast.

Various companies, including Reury Mines of Canada, and Vestgrou Mines, a Cominco subsidiary, were exploring for chromite, lead, and zinc. Supposedly, chromite deposits were located between Godthaab and Frederkshaab on the southwest coast, and lead and zinc deposits near Marmorilik fjord on the west coast. The future of both areas was uncertain as both projects were in the exploration stage.

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ICELAND

During 1968 Iceland remained dependent upon imports to satisfy practically all its requirements. Domestic output was limited to minor quantities of foundry products, fertilizer materials, and a few industrial nonmetalics. The minerals industry contributed less than 1 percent to the gross national product. Consequently employment in the mineral industry was very small during 1968 as it was in past years. Iceland's 1967 (latest year for which complete data are available) mineral commodity imports were valued at $23.8 million and the value of exports amounted to $200,000. The following tabulation shows the relationship of mineral trade to total balance:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodity trade	Total commodity trade	
Exports:			
1966	0.2	140.8	0.1
1967	.2	97.0	.2
Imports:			
1966	22.9	159.0	14.4
1967	23.8	163.4	14.6
Trade balance:			
1966	—22.7	—18.2	XX
1967	—23.6	—66.4	XX

XX Not applicable.

Table 6.—Iceland: Production of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
Cement	108,100	114,100	114,600	115,904	• 108,000
Fertilizer materials:					
Gross weight	• 20,100	• 19,500	22,735	23,900	• 24,000
Nitrogen content	6,700	6,500	7,500	7,900	• 8,000
Limestone, (shell sand)—cubic meters	• 130,000	142,000	130,300	120,000	• 130,000
Pumice	10,000	• 10,000	• 10,000	• 10,000	NA
Sand and gravel—thousand tons	NA	NA	NA	3,770	4,000

• Estimate. NA Not available.

Mineral fuels constituted the largest part of expenditures on mineral imports during 1967 and accounted for 20.1 percent of total minerals imports. Liquid fuels were 99 percent of the total value of imported mineral fuel. The U.S.S.R. and United Kingdom were the principal suppliers.

The construction of the aluminum smelter continued at Hafnarfjodur. The smelter will start production in mid-1969 with an initial capacity of 30,000 tons of metal per year. Capacity will be increased by another 30,000 tons in 1972. The plant is owned by Icelandic Aluminum Co. Ltd. (Isal), a wholly owned subsidiary of Swiss Aluminium Ltd.

In addition the Government was apparently making preliminary contracts for the construction of a second aluminum smelter in the country. At yearend details of these contacts were not made public.

A diatomite plant with a capacity of 12,000 tons per year went onstream in July 1968. The company which operates the plant is jointly owned by the Government of Iceland (51 percent) and by the Johns-Manville Corporation (42 percent) of the United States. The management was contemplating the expansion of production to 24,000 tons of diatomite per year.

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Table 7.—Iceland: Selected mineral commodity trade

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destination or sources, 1967
EXPORTS			
Scrap, all kinds	1,743	1,232	NA.
IMPORTS			
METALS			
Aluminum and alloys unwrought and semimanufactures.	482	334	West Germany 88; Norway 64.
Copper and alloys, unwrought and semimanufactures.	236	235	West Germany 68.
Iron and steel; semimanufactures:			
Bars, rods, angles, shapes, sections	13,199	18,125	Czechoslovakia 2,814; Belgium-Luxembourg 2,290.
Universals; plates and sheets	10,268	9,252	Belgium-Luxembourg 2,935; West Germany 1,719.
Hoop and strip	675	749	NA.
Tubes, pipes and fittings	4,653	4,428	West Germany 1,453.
Lead and alloys, unwrought and semimanufactures.	304	267	NA.
Silver and platinum, all forms. value, thousands	-------	$118	NA.
NONMETALS			
Cement	43,948	43,189	Spain 32,087.
Clay products:	NA	8,645	Denmark 5,856.
Refractory	478	1,611	United Kingdom 498.
Nonrefractory	987	1,130	United Kingdom 416.
Fertilizers, manufactured:			
Nitrogenous Bulk	6,952	NA	
Phosphatic Bulk	10,448	8,656	Norway 2,721; Belgium-Luxembourg 2,406.
Potassic Bulk	9,176	7,356	East Germany 2,923; United Kingdom 2,300.
Other Bulk	4,800	11,769	Netherlands 11,412.
Salt	43,948	43,189	Spain 32,087.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,209	NA	
Coal, all grades, including briquets	5,006	5,485	Poland 4,878.
Coke and semicoke	804	NA	
Petroleum refinery products:			
Gasoline all kinds	56,535	64,605	U.S.S.R. 51,125.
Kerosine, jet fuels and white spirits	17,946	33,417	Netherlands Antilles 18,440; United Kingdom 14,928.
Distillate fuel oils	274,719	285,296	U.S.S.R. 288,046; Netherlands Antilles 27,030.
Residual fuel oils	135,287	107,899	U.S.S.R. 97,269.
Lubricants, including greases	5,293	4,489	United Kingdom 2,659.
Liquefied petroleum gas	374	400	NA.
Bitumen	3,579	5,000	NA.

NA Not available.

SWITZERLAND

Indigenous mineral resources sustained a modest output of several nonmetallic minerals including cement, lime, and gypsum. Switzerland's significant aluminum, and petroleum refining industries, based on imported raw materials, made substantial gains in 1968; however, production in both industries was slightly below capacity level.

The nation's growing energy requirements have stimulated extensive uranium exploration activities. Uranium-bearing ore deposits in Grisons and Valais Cantons were considered for possible exploitation. Two nuclear powerplants were under construction near Beznau with completion dates set for 1969 and 1971. An agreement was reached with the United Kingdom Atomic Energy Authority (UKAEA) for reprocessing the spent nuclear fuel from these plants at the UKAEA facility at Windscale. A third nuclear powerplant was approved for construction at Kaiseraugst. The 500-megawatt plant will be constructed by Motor Columbus A.G. of Baden.

The Swiss gross national product rose by 3.6 percent in 1968 as compared with a 1.9-percent increase in 1967. The economy is highly dependent upon trade with exports 21 percent and imports equalling 26 percent of the gross national product. The 1968 growth of 14 percent and 9 percent in exports and imports, respectively, pro-

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vided a base for the increased economic growth. Mineral commodity trade in relation to total trade is shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	189.0	2,939.0
1966	206.7	3,251.6
1967	207.9	3,470.9
Imports:		
1965	720.1	3,671.1
1966	754.3	3,917.6
1967	769.5	4,099.1

Nonferrous metal exports, principally aluminum products, constituted about 36 percent of the mineral export by value or $73 million in 1967 with substantial increases reported in 1968. Precious and semiprecious stones contributed about 33 percent or $67.5 million to total mineral exports. The European Economic Community (EEC) received about 51 percent of the mineral trade by value or $109.5 million, and the European Free Trade Association (EFTA) about 25 percent or $51.2 million.

Petroleum, iron and steel, and nonferrous ores and metals constituted 76 percent of total mineral imports by value or $586 million. The EEC continued to account for the major portion of mineral imports providing 62 percent ($77.7 million) in 1967. The proportion of EEC imports has, however, showed a steady decline compared with a 73-percent contribution ($524.1 million) in 1965 and a 66-percent contribution ($494.3 million) in 1966. Mineral commodity imports from North Africa, particularly Libya, Algeria, and Tunisia, have shown substantial growth with imports from that area in 1967 increased by 174 percent, contributing 7.7 percent of total mineral imports in 1967 compared with 2.9 percent in 1966.

Table 8.—Switzerland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Aluminum, metal, primary	64,235	67,150	68,725	72,320	76,855
Iron and steel:					
Iron ore and concentrate, thousand tons	90	113	66	4	----
Pig iron, do	30	25	25	24	22
Ferroalloys (ferrosilicon), do	2	2	2	2	6
Steel, ingots and castings, do	370	370	456	445	453
Steel semimanufactures, do	----	----	460	480	490
NONMETALS					
Cement, hydraulic, do	4,322	4,089	4,326	4,176	4,321
Gypsum e, do	100	100	100	100	100
Lime, do	200	177	167	153	147
Salt, do	182	230	188	216	255
MINERAL FUELS AND RELATED MATERIALS					
Coke, gas plant	469,159	452,300	408,614	275,000	250,000
Gas, manufactured, all types, million cubic feet	11,994	12,334	12,255	12,608	13,642
Petroleum refinery products:					
Gasoline	157,000	223,000	407,000	693,000	711,000
Kerosine and jet fuel	8,000	6,000	19,000	63,000	62,000
Distillate fuel oils	367,000	444,000	923,000	1,624,000	1,930,000
Residual fuel oil	298,000	368,000	750,000	1,271,000	1,393,000
Lquified petroleum gas	----	----	----	201,000	212,000
Asphalt, refinery	----	----	----	----	80,000
Other	27,000	44,000	13,000	74,000	87,000

e Estimate. p Preliminary.

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Table 9.—Switzerland: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum:			
Oxide and hydroxide	103	66	West Germany 22; Japan 12; Italy 7.
Metal, including alloys:			
Unwrought	22,465	19,829	West Germany 6,845; United Kingdom 4,969; Italy 3,459.
Semimanufactures	24,340	26,374	Sweden 2,677; Denmark 2,606.
Cobalt oxide and hydroxide	2	3	France 2; West Germany 1.
Columbium and tantalum, tantalum metal, including alloys, all forms.	10	14	United States 9; United Kingdom 1; Austria 1; Poland 1.
Copper:			
Matte	160	NA	
Metal, including alloys:			
Scrap	11,203	10,451	West Germany 6,285; Italy 1,072.
Unwrought	4,023	4,595	Italy 1,897; West Germany 1,688.
Semimanufactures	11,010	9,966	United States 3,445; Italy 1,327; Israel 1,317.
Gold metal, thousand troy ounces, unworked or partly worked.	817	888	West Germany 303; France 238; Canada 134.
Iron and steel:			
Ore and concentrate, including roasted pyrite.	31,652	14,568	West Germany 14,562.
Metal:			
Scrap	16,841	30,509	Italy 20,404; West Germany 6,875.
Pig iron, including cast iron, sponge iron, powder and shot.	317	3	NA.
Ferroalloys	9,945	11,950	West Germany 5,618; Italy 4,805.
Steel, primary forms	3,910	5,271	Italy 5,242.
Semimanufactures:			
Bars, rods, angles, shapes, sections	43,523	22,384	Italy 11,520; Austria 4,459; West Germany 3,253.
Universals, plates and sheets	2,034	3,149	Austria 1,896; France 614; West Germany 341.
Hoop and strip	1,756	2,589	Austria 1,317; West Germany 511.
Rails and accessories	351	NA	
Wire	4,505	5,640	Italy 1,636; France 1,330.
Tubes, pipes, and fittings	37,452	39,917	United States 7,071; Austria 5,067.
Castings, and forgings, rough	179	136	NA.
Total	89,800	73,765	
Lead metal, including alloys:			
Scrap	5,483	5,287	Italy 5,220.
Unwrought	37	20	West Germany 20.
Semimanufactures	162	256	Austria 128; France 67; Belgium-Luxembourg 25.
Magnesium metal, including alloys, all forms	109	100	West Germany 74.
Mercury, 76-pound flasks	r 98	94	West Germany 72; Denmark 12.
Molybdenum metal, including alloys, all forms.	-------	2	United Kingdom 1.
Nickel:			
Matte, speiss, and similar materials	40	76	West Germany 39; Italy 29.
Metal, including alloys:			
Scrap	645	519	West Germany 273; Belgium-Luxembourg 70; United Kingdom 62.
Unwrought	NA	60	NA.
Semimanufactures	1,010	950	France 159; West Germany 135; Italy 127.
Platinum-group metals and silver, including alloys:			
Platinum-group, thousand troy ounces	73	85	Italy 34; France 15.
Silver, do	6,253	6,116	Italy 1,525; West Germany 1,095; France 806; Austria 706.
Silicon, elemental	3,863	4,395	West Germany 1,744; U.S.S.R. 842.
Tin metal, including alloys:			
Scrap, long tons	86	60	West Germany 42; France 15.
Unwrought and semimanufactures, do	r 90	72	Austria 35; West Germany 28.
Tungsten, including alloys, all forms	24	26	West Germany 25.
Zinc metal, including alloys:			
Scrap	1,085	1,257	Italy 1,126.
Unwrought	643	391	Italy 259; Austria 104.
Semimanufactures	r 199	232	Netherlands 91; United Kingdom 40; West Germany 31.
Other:			
Ash and residues containing nonferrous metals.	14,902	16,524	Italy 6,014; West Germany 5,602; Belgium-Luxembourg 3,200.

See footnotes at end of table.

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Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS—Continued			
Other—Continued			
Metals, including alloys, all forms:			
Alkali, alkaline earth and rare earth metals. kilograms	596	630	NA.
Base metals, including alloys, all forms, n.e.s.	16	19	Netherlands 10; West Germany 3; United Kingdom 2.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	46	16	NA.
Grinding and polishing wheels and stones	616	635	West Germany 193; United Kingdom 114.
Asbestos	85	74	West Germany 30; Sweden 12; France 7.
Cement	138,531	23,894	West Germany 18,894; France 3,520.
Chalk	8	31	West Germany 2.
Clay and clay products (including all refractory brick):			
Crude clay	5,710	10,598	West Germany 9,912.
Products:			
Refractory (including nonclay bricks).	859	1,253	NA.
Nonrefractory	59,194	49,738	West Germany 20,286; France 15,310; Austria 11,457.
Diamond:			
Gem, not set or strung. value, thousands	NA	$10,860	West Germany $2,850; France $2,449; United States $1,256.
Industrial do	NA	$1,082	United States $360; Belgium-Luxembourg $299; Netherlands $186.
Diatomite and other infusorial earth	74	48	Austria 23; West Germany 15; France 4.
Feldspar and fluorspar	r 109	77	West Germany 32; Sweden 28.
Fertilizer materials, manufactured:			
Nitrogenous	31,923	22,263	United Kingdom 14,142; France 4,553.
Other	54	121	West Germany 103.
Graphite, natural	24	50	West Germany 26; France 21.
Gypsum and plasters	111	1,366	Austria 1,293.
Lime	2,153	2,141	France 1,220; West Germany 744.
Magnesite	79	47	France 9; West Germany 7.
Mica:			
Crude, including splittings and waste	5	60	Sweden 18; West Germany 16; France 12.
Worked, including agglomerated splittings.	161	209	Netherlands 29; Austria 28; West Germany 24; Norway 20.
Precious and semiprecious stone, except diamond:			
Natural thousand carats	19,845	28,750	West Germany 10,200; United Kingdom 8,305; United States 3,010.
Manufactured do	246,925	186,520	West Germany 70,330; Italy 40,365.
Salt and brines	2,079	7	West Germany 6.
Sodium and potassium compounds, n.e.s.:			
Caustic soda	564	8,061	Belgium-Luxembourg 4,500; Czechoslovakia 1,916; Yugoslavia 811.
Caustic potash	28	14	All to France.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked	31,604	33,107	West Germany 25,071.
Worked	5,692	5,860	West Germany 4,884.
Dolomite	57	63	France 5.
Gravel and crushed rock	57,373	36,954	West Germany 22,134; France 9,074; Austria 4,179.
Limestone (except dimension)	169	31	Austria 30.
Quartz and quartzite	19,783	15,058	Italy 11,563.
Sand, excluding metal-bearing	25,409	13,632	West Germany 5,048; France 4,784; Austria 3,025.
Sulfur:			
Elemental	297	226	All to West Germany.
Sulfuric acid	6,759	7,172	West Germany 6,471.
Talc, steatite, soapstone, pyrophyllite	r 536	1,734	Italy 1,706.
Other nonmetals, n.e.s.: Bromine, iodine, fluorine.	13,667	13,834	NA.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	2,942	2,349	United Kingdom 2,310.
Carbon black	209	152	Italy 64.
Coal, all grades, including briquets	3	3	All to West Germany.
Coke and semicoke	207	23,040	Italy 11,580; West Germany 6,779.
Hydrogen, helium, rare gases	4	3	France 1.
Peat, including peat briquets and litter	582	185	Austria 125; West Germany 25.

See footnotes at end of table.

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Table 9.—Switzerland: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinaions, 1967
MINERAL FUELS AND RELATED MATERIALS —Continued			
Petroleum refinery products:			
Gasoline (including natural) thousand tons	16	11	Austria 10.
Distillate fuel oil ---do---	11	9	All to Austria.
Residual fuel oil ---do---	107	155	Do.
Lubricants ---do---	2	3	NA.
Other:			
Petroleum coke ---do---	7	11	West Germany 6; France 5.
Bituminous mixtures, n.e.s	241	436	Yugoslavia 128; Finland 107; West Germany 51.
Mineral tar and other coal, petroleum, or gas derived crude chemicals.	1,780	1,464	West Germany 291; Italy 222; Austria 169.

r Revised. NA Not available.

Table 10.—Switzerland: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite and concentrate	1,985	592	Italy 275; France 200; United Kingdom 109.
Oxide and hydroxide	184,672	144,165	France 78,671; Guinea 24,549; Surinam 20,126.
Metal, including alloys:			
Unwrought	13,887	6,801	Norway 3,112; Austria 1,898; U.S.S.R. 786.
Semimanufactures	7,253	6,722	West Germany 3,724; United Kingdom 763; Netherlands 753.
Antimony metal, including alloys, all forms	700	659	Mainland China 169; Belgium-Luxembourg 162; Republic of South Africa 122; Japan 78.
Arsenic trioxide, pentoxide, and acids	87	86	Sweden 31; U.S.S.R. 30; France 25.
Beryllium metal, including alloys, all forms. kilograms	39	47	France 5.
Chromium:			
Chromite	3,354	3,972	NA.
Oxide and hydroxide	475	521	West Germany 272; United Kingdom 90; France 67.
Cobalt oxide and hydroxide	11	5	Belgium-Luxembourg 3; Canada 2.
Columbium and tantalum:			
Tantalum metal, including alloys, all forms. kilograms	r 1,308	3,418	West Germany 3,226.
Copper:			
Matte	445	339	France 127; Italy 115.
Metal, including alloys:			
Scrap	547	558	West Germany 347; Israel 159.
Unwrought	42,846	42,274	Belgium-Luxembourg 14,887; Zambia 8,612; West Germany 6,267.
Semimanufactures	23,565	21,200	United Kingdom 7,784; West Germany 3,767; Canada 2,835; Italy 2,209.
Gold metal, unworked and partly worked. thousand troy ounces	364	437	France 189; West Germany 119.
Iron and steel:			
Ore and concentrate, including roasted pyrite.	7,240	21,489	Brazil 15,160.
Metal:			
Scrap	52,943	22,796	East Germany 11,882; West Germany 6,689; Austria 3,158.
Pig iron, including cast iron, sponge iron, spiegeleisen, powder and shot.	64,698	56,615	West Germany 34,350; Netherlands 5,879.
Ferroalloys	16,527	11,106	West Germany 1,757; Norway 1,330.
Steel, primary forms	172,289	162,785	France 81,309; West Germany 62,147.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Iron and steel—Continued			
Semimanufactures:			
Bars, rods, angles, shapes, sections:			
Wire rod—thousand tons	48	47	France 21; West Germany 12; Austria 9; Netherlands 5.
Other bars and rod—do	140	127	West Germany 55; France 38.
Angles shapes and sections—do	188	204	West Germany 76; France 63; Belgium-Luxembourg 58.
Universals, plates and sheets—do	461	486	France 171; West Germany 144.
Hoop and strip—do	133	137	Belgium-Luxembourg 43; Austria 32; West Germany 28; France 25.
Rails and accessories—do	48	42	Austria 13; West Germany 12; Belgium-Luxembourg 8; Italy 5.
Wire—do	21	21	West Germany 8; Austria 6; United Kingdom 2.
Tubes, pipes, and fittings—do	115	113	West Germany 66; France 23.
Castings and forgings, rough—do	3	3	West Germany 2.
Total	1,157	1,180	
Lead:			
Oxides	328	236	Mexico 98; West Germany 74; France 50.
Metal, including alloys:			
Unwrought, including scrap	21,010	20,237	Canada 5,198; France 4,735; Belgium-Luxembourg 2,452; West Germany 2,308.
Semimanufactures	517	567	West Germany 478.
Magnesium metal, including alloys, all forms	677	1,044	Norway 938.
Manganese:			
Ore and concentrate	460	NA	
Oxides	475	620	Japan 429; West Germany 85; Belgium-Luxembourg 76.
Mercury—76-pound flasks	r 725	319	West Germany 101; Italy 57; Belgium-Luxembourg 50; Spain 42.
Molybdenum metal, including alloys, all forms	11	12	West Germany 5; United Kingdom 4; Austria 3.
Nickel:			
Ore and concentrate	49	NA	
Metal including alloys:			
Scrap	-------	191	Mainly from Common Market countries.
Unwrought	1,359	1,122	United Kingdom 543; Norway 336; France 121.
Semimanufactures	1,106	1,112	West Germany 404; United Kingdom 389.
Platinum-group metals and silver: Metals, including alloys, all forms:			
Platinum group—thousand troy ounces	73	109	West Germany 39; U.S.S.R. 37; United Kingdom 16.
Silver—do	20,198	20,822	United States 13,108.
Silicon metal, including alloys, all forms	486	278	Italy 250.
Tin:			
Oxide—long tons	35	21	West Germany 16; United Kingdom 4.
Metal, including alloys:			
Unwrought—do	865	868	Netherlands 297; Malaysia 228; Thailand 147; United Kingdom 121.
Semimanufactures—do	141	117	Mainly from Common Market countries.
Titanium oxides	6,983	7,327	West Germany 3,023; United Kingdom 2,310.
Tungsten:			
Ore and concentrate	45	45	Portugal 40.
Metal, including alloys, all forms	51	72	West Germany 63; France 7.
Zinc:			
Oxide	1,420	1,308	West Germany 482; Belgium-Luxembourg 229; Netherlands 197.
Metal, including alloys:			
Unwrought	24,738	24,501	Belgium-Luxembourg 9,669; West Germany 5,619.
Semimanufactures	1,728	1,764	Belgium-Luxembourg 853; West Germany 550.
Other:			
Ore and concentrate	4,040	3,972	Australia 1,954.
Ash and residues containing nonferrous metals.	790	1,515	Mainly from Common Market countries.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS—Continued			
Other—Continued			
Metals, including alloys, all forms:			
Metalloids	r 1,516	1,389	West Germany 648; France 641.
Alkali, alkaline earth and rare metals.	157	266	West Germany 250.
Pyrophoric alloys	12	11	West Germany 5; Austria 2.
Base metals, including alloys, all forms.	700	659	Mainland China 170; Belgium-Luxembourg 161; Japan 74.
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc.	3,041	1,519	Italy 705; West Germany 677.
Grinding and polishing wheels and stones	1,408	1,357	West Germany 655; United Kingdom 170; Austria 156.
Asbestos	15,772	12,712	Canada 7,573; Republic of South Africa 2,847.
Barite and witherite	3,378	2,249	West Germany 1,860; France 257.
Boron materials:			
Crude natural borates	466	752	United States 651; Turkey 100.
Oxide and acid	575	486	France 371; Italy 97.
Cement	36,571	30,665	France 14,494; West Germany 5,340; Italy 4,388; Denmark 3,316.
Chalk	11,612	11,827	France 11,516.
Clay and clay products (including all refractory brick):			
Crude clays, n.e.s	197,456	181,542	West Germany 73,867; United Kingdom 54,487; France 29,975.
Products:			
Refractory (including nonclay bricks).	21,766	20,740	West Germany 13,415; France 2,402; Austria 2,146.
Nonrefractory	131,965	115,926	Italy 92,520; West Germany 13,618.
Cryolite and chiolite	516	890	Denmark 890.
Diamond, industrial—value, thousands	NA	$1,339	Belgium-Luxembourg $388; Republic of South Africa $303; United Kingdom $220.
Diatomite and other infusorial earths	2,045	1,949	United States 544; West Germany 403; Denmark 322.
Feldspar and fluorspar	14,711	14,827	France 6,798; West Germany 3,998; Italy 2,390.
Fertilizer materials:			
Crude:			
Nitrogenous	310	381	West Germany 236; East Germany 100.
Phosphatic	29,359	27,497	Morocco 17,842; Belgium-Luxembourg 8,202.
Potassic	82,005	83,032	France 55,606; West Germany 22,486.
Other	20,358	19,914	NA.
Manufactured:			
Nitrogenous	1,387	4,469	West Germany 2,477.
Phosphatic:			
Thomas (basic) slag	194,322	200,530	France 131,245; Belgium-Luxembourg 69,251.
Other	14,827	16,432	France 7,051; Netherlands 3,749; Belgium-Luxembourg 3,272.
Potassic	21,409	15,190	France 13,182.
Other, including mixed	19,033	21,881	France 9,944; West Germany 7,593; Italy 3,424.
Ammonia	13,994	9,409	Austria 5,173; West Germany 3,654.
Graphite, natural	626	470	Austria 228; West Germany 168.
Gypsum and plasters	56,104	59,866	West Germany 31,300; Austria 19,798; Italy 8,118.
Lime	14,124	14,921	Italy 13,426.
Magnesite	4,114	3,362	Austria 3,210.
Mica:			
Crude, including splittings and waste	627	640	West Germany 289; Norway 156; United Kingdom 126.
Worked, including agglomerated splittings.	94	214	France 155; Belgium-Luxembourg 55.
Pigments, mineral:			
Natural, crude	437	372	France 115; West Germany 69; Sierra Leone 78.
Iron oxides, processed	1,787	2,043	West Germany 1,935.
Precious and semiprecious stone, except diamond:			
Natural—thousand carats	188,165	126,305	Brazil 51,145; United States 17,395; West Germany 12,925.
Manufactured—do	95,580	93,915	France 88,760.

See footnotes at end of table.

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Table 10.—Switzerland: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
NONMETALS—Continued			
Pyrite (gross weight)	46,314	45,987	Italy 45,839.
Salt and brines	1,121	943	France 799.
Sodium and potassium compounds n.e.s.:			
Caustic soda	4,301	4,792	West Germany 2,004; France 1,541; Italy 775.
Caustic potash, soda and potassic peroxides.	2,874	3,136	France 1,236; West Germany 1,212; East Germany 583.
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous	81,850	51,785	Austria 19,952; France 16,183; Italy 13,109.
Slate	2,809	2,836	West Germany 2,544.
Other	33,362	39,766	West Germany 21,532; Italy 10,914; France 5,631.
Worked:			
Slate	1,261	1,391	Italy 1,035; France 158.
Paving and flagstone	12,958	16,431	Italy 10,307; Austria 5,508.
Other	7,615	7,674	Italy 5,784; West Germany 1,019.
Dolomite	13,107	12,676	Italy 7,359; France 3,038.
Gravel and crushed thousand tons rock.	2,822	3,558	France 1,872; West Germany 927; Italy 707.
Limestone (except dimension)	65,048	56,031	France 46,242; Italy 8,874.
Quartz and quartzite	14,299	10,649	Italy 7,172.
Sand, excluding metal thousand tons bearing.	852	857	Italy 463; Belgium-Luxembourg 134; France 125; West Germany 124.
Sulfur:			
Elemental:			
Other than colloidal	55,287	42,111	United States 21,861; France 19,396.
Colloidal	243	187	West Germany 147.
Sulfur dioxide	17	19	NA.
Sulfuric acid	r 900	962	West Germany 502; France 400.
Talc, steatite, soapstone, and pyrophyllite	12,737	12,738	France 5,505; Austria 4,184; Italy 1,490.
Other nonmetals, n.e.s.:			
Crude	40,427	64,029	France 22,680; West Germany 17,294; Italy 16,052.
Slag, dross and similar waste, not metal bearing.	41,582	48,878	France 30,738; West Germany 10,442; Italy 7,657.
Oxides and hydroxides of magnesium, strontium, barium.	177	194	West Germany 73; United Kingdom 50.
Bromine, iodine, fluorine	897	1,001	France 806; Japan 144.
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural	862	1,013	Trinidad and Tobago 771; United States 203.
Carbon black	7,117	6,985	France 1,874; West Germany 1,670; Netherlands 1,245; Italy 1,213.
Coal, and briquets:			
Anthracite and thousand tons bituminous coal.	888	644	West Germany 313; United States 85; Belgium-Luxembourg 71; Czechoslovakia 65.
Briquets of anthracite and do bituminous coal.	23	20	West Germany 7; France 6; Netherlands 5.
Lignit and lignite briquets do	119	106	West Germany 101.
Coke and semicoke do	367	282	West Germany 189; Netherlands 66.
Hydrogen, helium, rare gases	r 199	777	Italy 585; France 83.
Peat and peat briquets thousand tons	41	39	West Germany 36.
Petroleum:			
Crude and partly refined do	2,353	3,936	Algeria 2,000; Libya 942.
Refinery products:			
Gasoline (including thousand tons natural).	1,341	1,140	Italy 381; France 342; West Germany 242.
Kerosine and jet fuel do	73	50	Italy 18; France 16; Netherlands 11.
Distillate fuel oil do	3,857	3,265	Italy 824; West Germany 698; France 592; Belgium-Luxembourg 400.
Residual fuel oil do	840	611	France 304; West Germany 203; Italy 71.
Lubricants do	73	78	Italy 20; Netherlands 15; United Kingdom 12.
Liquified petroleum gases do	13	NA	
Mineral jelly and wax do	7	8	West Germany 3; United States 1; East Germany 1.
Other:			
Petroleum and pitch do coke.	51	51	West Germany 28; United States 21.
Bitumen and other do residues.	268	267	France 132; West Germany 78; Italy 32.
Mineral tar and other coal, petroleum, or gas derived crude chemicals. do	21	24	France 8; West Germany 7; Czechoslovakia 3.

r Revised. NA Not available.

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The Mineral Industry of Other Areas of Africa

By Henry E. Stipp [1] and Eugene R. Slatick [2]

CONTENTS

	Page		Page
Botswana	891	Malagasy Republic	910
Burundi	893	Malawi	913
Cameroon	894	Mali	914
Central African Republic	896	Mauritania	916
Chad	898	Niger	918
Congo (Brazzaville)	899	Rio Muni	920
Dahomey	901	Rwanda	920
Ethiopia	902	Senegal	921
Fernando Po	904	Somali Republic	924
French Territory of the Afars and Issas	904	Southern Rhodesia	925
Gambia	905	Spanish Sahara	927
Guinea	905	Sudan	928
Ivory Coast	907	Swaziland	929
Lesotho	909	Togo	931
		Upper Volta	933

BOTSWANA [3]

The Republic of Botswana continued to make progress in developing its mineral industry, although the production of mineral commodities contributed little in value to the economy of the country in 1968. Significant advancement was made in establishing the size and grade of recently discovered copper and nickel deposits. The possibility that a diamond-bearing kimberlite pipe also would be developed enhanced the potential importance of the mineral industry to the economy. In January, the Government of Botswana signed an Investment Guaranty Agreement with the United States, designed to protect and encourage private investment in economic development of the country. Botswana's Government enacted legislation covering procedures for obtaining permits and licenses for prospecting and mining. Other requirements relating to mining activity also are described in the mineral code entitled "The Mines and Minerals Act, 1967." In July Botswana joined the International Monetary Fund, the International Bank for Reconstruction and Development, and the International Development Association. These organizations will be helpful in raising funds for expansion of Botswana's mineral industry and ancillary facilities. A preinvestment survey of infrastructure required for large-scale development of copper and nickel deposits was being conducted by Sir Alexander Gibb and Partners Ltd. of London. The United Nations allocated $383,400 and the Government of Botswana the equivalent of $624,000 for the survey, which was scheduled for completion in October. In August the Government issued a National Development Plan (1968–73),

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[3] Prepared by Henry E. Stipp.

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designed to guide the economic and social development of the nation.

Production of mineral commodities in 1968 was valued at about $945,000 [4] compared with $60,400 in 1967. Manganese ore valued at $941,000 was the most important mineral produced. In 1968, two firms mined manganese ore; Marble Lime and Associated Industries from a mine near Lobatse and Botswana Exploration and Mining Co. (Pty.) Ltd. from the Kgwa Kgwe mine.

Table 1.—Botswana: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content--troy ounces--	10	--------	--------	--------	--------
Manganese, ore and concentrate, gross weight metric tons--	27,795	8,815	7,000	4,253	24,098
Silver, mine output, metal content--troy ounces--	1	--------	--------	--------	--------
NONMETALS					
Asbestos, chrysotile----------metric tons--	1,960	806	800	--------	--------
Gem stones, rough, semiprecious-----kilograms--	--------	--------	--------	--------	1,835
Talc and related materials: Talc----metric tons--	--------	48	--------	726	125

[1] In addition to commodities listed, simple construction materials such as clay and sand and gravel are produced, but quantitative data are not available.

The principal mineral commodity exported in 1968 was 9,282 tons of manganese ore valued at about $305,371. Exports in 1967 consisted of manganese ore valued at $31,922 and talc valued at $1,120. Exports were shipped principally to the Republic of South Africa and Southern Rhodesia. In 1967 imports of mineral commodities consisted mainly of mineral fuels valued at $3.4 million, iron and steel semimanufactures valued at $1.1 million, and cement valued at $129,000. The role of mineral commodity trade relative to total trade was as follows:

	Value (thousand dollars)	
	[1] Mineral commodity trade	Total commodity trade
Exports:		
1965	304	r 14,334
1966	35	15,081
1967	33	12,906
Imports:		
1965	NA	23,227
1966	r 5,567	26,355
1967	4,720	27,965

NA Not available. r Revised.
[1] Values given are for only those commodities listed in table 2 of this chapter.

Development of the copper and copper-nickel deposits discovered by Botswana Roan Selection Trust Ltd. was advanced considerably by the Government of Botswana when it secured the backing of the World Bank to finance construction of the Shashi complex. Initial construction at the complex will consist of facilities such as roads, railroads, water resources, and powerplants, which are necessary for development of the copper-nickel deposits. More

Table 2.—Botswana: Foreign trade in selected mineral commodities

(Exports in metric tons; imports in thousand U.S. dollars)

Commodity	1966	1967 [1]
EXPORTS		
METALS		
Manganese ore and concentrate---	874	4,253
NONMETALS		
Asbestos----------	103	------
Talc----------	------	73
IMPORTS		
METALS		
Iron and steel semimanufactures--	$2,625	$1,050
NONMETALS		
Asbestos sheets----------	40	25
Bricks and tiles----------	45	40
Cement----------	120	129
Fertilizers----------	16	33
Salt----------	75	29
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke----------	22	26
Gasoline----------	970	1,180
Diesel fuel oil----------	990	1,257
Paraffin oil----------	124	169
Lubricating oil----------	160	270
Other----------	380	512
Total----------	2,646	3,414

[1] Source: Republic of Botswana (Gaberones). Statistical Abstract. 1968, pp. 49–52.

[4] Where necessary, monetary values have been converted at the rate of South African Rand (R) R1 = US$1.40.

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than 25 million tons of copper-nickel ore averaging 1.36 percent copper and 1.12 percent nickel has been discovered in the vicinity of Francistown at Selibe and Phikwe.[5] About 8 million tons of copper ore, averaging from 2.15 to 2.87 percent copper, also has been proved or indicated in the Matsitomma area. Exploitation of these deposits reportedly would have to be by costly underground methods.

A diamond-bearing kimberlite pipe discovered at Orapa, 120 miles west of Francistown, by De Beers Consolidated Mines Ltd., could become a major source of diamonds.[6] In November, pits were being sunk to 120-foot depth on a close grid pattern and kimberlite rock was being processed in three heavy-media separation plants, having a combined capacity of 300 tons per day. At yearend, the company was planning to work the deposit on a large scale.[7] Profit would be divided about equally between the Botswana Government and the company. Diamonds recovered so far indicate that much of the output would consist of industrial stones of poor quality.

BURUNDI [8]

The mineral industry of Burundi is small compared to the agricultural sector of the economy, which accounts for about 70 percent of the gross domestic product and 90 percent of total exports. Nevertheless the Government of Burundi was backing a comprehensive mineralogical research project, conducted by the United Nations Development Program, in hope of finding rich mineral deposits, which would advance the economy of the country. In January the United Nations allocated $962,300 [9] for the survey, which would include photogeologic exploration by helicopter and geochemical and geophysical prospecting in detail of some 2,000 square miles.

Production of mineral commodities in 1968 was valued at about $640,000 compared with almost $357,000 in 1967. Gold output was valued at about $23,000 in 1968. Reportedly only one small mine at Kayanza in Mgozi Province was operating in 1968.

Detailed data on trade in mineral commodities were incomplete; however, all of the bastnaesite output was shipped to France. The most important mineral reexported was diamond (originating outside of Burundi) valued at more than $3 million, which was shipped to United Kingdom. Most of the cassiterite concentrate produced in Burundi was exported to West European countries. The principal mineral import was iron and steel semimanufactured products valued at $374,000. Trade in mineral commodities (except for reexported diamond) represented a small part of total trade.

A bastnaesite mine operated by Société Minerale de Karonge (SOMIKA) is located at Karonge in Bujumbura Province. The mine consists of a single shaft that intersects narrow veins of ore, which are mined chiefly by hand. A washing plant located at the mine concentrates the ore to 68 to 70 percent rare-earth oxides. Two shaking tables also are employed in concentrating the ore. The mine employs 250 workers and maintains the only improved road in the region.

[5] Skillings' Mining Review. Copper in Africa. V. 57, No. 51, Dec. 21, 1968, p. 19.
[6] Mining Journal (London). V. 272, No. 6974, Apr. 18, 1969, p. 325.
[7] The Standard Bank Review (Johannesburg). No. 603, June 1968, p. 20.
[8] Prepared by Henry E. Stipp.
[9] Where necessary, monetary values have been converted at the rate of 87.8 Burundi francs equals US$1.

Table 3.—Burundi: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
Gold: Mine output, metal content—troy ounces	-------	-------	1,125	482	643
Rare-earth metals: Bastnaesite concentrates, gross weight—metric tons	-------	150	200	300	525
Tin: Ores and concentrate, gross weight—long tons	22	17	49	r 45	148

r Revised.
[1] In addition to commodities listed construction materials such as clay and sand and gravel are produced, but quantitative data are not available.

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Table 4.—Burundi: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Copper, metal and alloys, unwrought	50	300
Zinc, metal and alloys, unwrought	------	100
Nonferrous base metal ore concentrates	------	54
NONMETALS		
Diamond, gem, value, thousands	$460	$3,034
Fertilizer materials:		
Phosphatic	2,200	NA
Others	120	300
IMPORTS		
METALS		
Iron and steel: Metal:		
Semimanufactures	1,451	908
NONMETALS		
Pigments	41	31
MINERAL FUELS AND RELATED MATERIALS		
Petroleum products: Lubricants and greases	213	NA

NA Not available.

Source: Supplement to the World Trade Annual, v. 3, 1967, pp. 463–466.

CAMEROON [10]

The mineral industry of the Federal Republic of Cameroon, which consisted principally of gold and tin ore (cassiterite) mining and aluminum manufacture, contributed an estimated 2.6 percent to the gross national product of $860 [11] million in 1968. Although the mineral industry was small compared to the agricultural sector, which dominates the economy, growth of the industrial sector in general was reportedly gaining. A liberal investment code and an Investment Guaranty Agreement with the United States has helped to increase private foreign investment. In fiscal year 1967, nearly $25 million was invested in private industry. In 1968 the Government of Cameroon was moving toward establishing a company to conduct further studies of the estimated 1.2 billion tons of low-grade bauxite located near Minim-Martap. The Government also contracted with Bureau de Recherches Géologiques et Minières (BRGM) to conduct several geologic surveys of potentially rich mineral areas. In 1968 Cameroon's Mining Taxation Code was amended by the adoption of Law No. 68/LF/13 of November 18. The amendment increased fees, which are paid for issuance and renewal of prospecting licenses and for the surface concession tax.

Production of mineral commodities generally was down somewhat from 1967 output. Manufacture of primary aluminum, which decreased 6 percent, probably de-

[10] Prepared by Henry E. Stipp.

[11] Where necessary, monetary values have been converted from Communanté Financiere Africiane (CFA) francs to U.S. dollars at the rate of CFA frances 248 equal US$1.

Table 5.—Cameroon: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
Aluminum, metal; primary—metric tons	51,507	50,487	48,159	48,324	45,391
Gold, mine output, metal content—troy ounces	739	1,286	675	991	465
Tin, mine output, metal content—long tons	40	40	25	51	• 60

• Estimate.

[1] In addition to commodities listed construction materials such as clay, sand and gravel are produced but quantitative data are not available.

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clined from the lack of a steady supply of electric power. Gold output declined 53 percent, probably as a result of mining lower grade ore in the Betaie-Oya region.

Cameroon had a favorable balance of trade with countries outside of the Central African Customs and Economic Union in 1967, both in mineral commodities and total trade as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade [2]
Exports:		
1965	20.7	140.1
1966	21.1	146.2
1967	23.5	170.6
Imports:		
1965	28.1	152.7
1966	25.1	147.4
1967	18.5	140.5

[1] Includes only those commodities listed in tables 6 and 7 of this chapter.

[2] Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967.

Exports of aluminum ingot, valued at more than $23.3 million, were the main reason for a favorable balance in minerals trade, although a decrease in the principal mineral commodity imported, semimanufactured iron and steel products, valued at $6 million also helped. Other significant mineral commodity imports were aluminum metal valued at $3.3 million and petroleum refinery products valued at $3.2 million.

Table 6.—Cameroon: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal	46,581	[1] 49,543
Iron and steel: Metal:		
Scrap	NA	845
Semimanufactures	244	NA
Lead	31	NA
Nonferrous ores and concentrates, n.e.s.	33	52
NONMETALS		
Cement, lime, etc.	14	NA
Clay and clay products	9	NA
Nonmetallic minerals, crude, n.e.s.	93	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	77	NA

NA Not available.

[1] Principal destinations: France 43,083; Belgium-Luxembourg 5,584; Italy 630.

Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 401–412.

Table 7.—Cameroon: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Alumina	45,528	NA
Metal	4,293	4,724
Copper, metal	40	82
Iron and steel:		
Pig iron and ferroalloys	225	186
Steel ingots and equivalent forms	329	496
Semimanufactures:		
Bars, rods, sections	12,154	9,128
Plate, sheet, strip	7,556	10,140
Rails and accessories	15,224	NA
Wire	1,210	2,300
Tubes, pipes, fittings	1,989	7,749
Total	38,133	29,317
Lead	21	59
Tin—long tons	1	NA
Zinc	6	NA
NONMETALS		
Abrasive, natural	157	202
Barium sulfate	------	1,356
Cement, lime etc.	100,860	134,535
Clay and clay products	2,441	2,764
Fertilizer materials, manufactured	14,779	30,118
Salt	------	22,032
Stone, sand and gravel	1,268	151
Nonmetallic minerals, crude, n.e.s.	11,190	24,889
Nonmetallic mineral manufactures, n.e.s.	155	------
Pigments, paints	------	1,320
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	464	NA
Gas, natural and manufactured	839	NA
Petroleum; refinery products	166,685	69,077
Tar, pitch and other crude chemicals from coal, oil, and gas distillation	505	3,036

NA Not available.

Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 401–412.

The aluminum rolling mill owned by Société Camerounaise de Transformation de l'Aluminum, and the hydroelectric power system, designed to supply adequate power to the Compagnie Camerounaise de l'Aluminum Pechiney-Ugine (ALUCAM) smelter at Edea, and to other facilities, were dedicated in February by President Ahidjo.[12]

Production of primary aluminum, which dropped significantly from the 1967 level, should be boosted by completion of the powerplant and dam construction at M'Bakaou, 435 miles upstream from Edea, by 1970. In the past ALUCAM attributed lost production to a drop in hydroelectric

[12] U.S. Embassy, Yaoundé. State Dept. Airgram A-148, Feb. 28, 1968, p. 1.

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power furnished by the Sanaga River, which depends upon seasonal rainfall for a steady flow. There has been no further progress made toward the development of Cameroon's extensive bauxite deposits.

Traces of copper were discovered in the Poli area 62 miles south of Garoua, but no information was available on the grade of the ore and reserves. Research was being conducted by BRGM under a contract with the Government of Cameroon. Eight expatriate scientists and 200 laborers are currently employed on the project.

Jack Grynberg and Associates, a U.S. company, applied for a permit to survey for uranium in the Benoue valley.

Limestone was used for preparation of lime in a plant in Figuil; however, no information was available on the quantity of limestone consumed. A cement plant was being constructed in the Figuil area and was expected to begin producing in late 1968.

In exploration for crude petroleum, four wildcat wells were completed offshore in 1967. One discovered oil and three were dry holes.[13] The average depth per well was 7,429 feet.

Shell-Camrex, a subsidiary of the Royal Dutch-Shell group, was awarded a 20-percent participation in the Rio dey Rey permit held by Société d'Etudes et de Recherches des Petroles du Cameroun (SEREPCA) a subsidiary of the French company Elf Union. Shell-Camrex will invest $2.32 million over a 2-year period. Also Shell-Camrex was granted 475 square miles of the original 950-square-mile Rio del Rey concession relinquished by SEREPCA. This new concession, the Lokele permit, will cost Shell-Camrex $1.4 million over a period of 4 years.[14] Mobil Exploration Equatorial Africa, began drilling its first wildcat well in March, 16 miles west of Kribi, southern Cameroon. The oceanographic research vessel M.S. *Gulfrex* explored in Cameroon waters and then proceeded to Port Gentil, Gabon. Amerada Petroleum Corp. of the United States was granted a new concession offshore and north of the border between Cameroon and Rio Muni, known as the Campo concession.

Standard Oil Co. of New Jersey (ESSO) opened its first service station, becoming the third U.S. firm marketing petroleum products in Cameroon. The firm plans to construct a chain of stations throughout the country.

CENTRAL AFRICAN REPUBLIC [15]

The mineral industry of the Central African Republic (CAR) in 1968 consisted principally of diamond mining. Exploitation of uranium deposits near Bakouma has not begun on a commercial scale; however, small quantities of ore may have been mined for research purposes. Diamond output value, estimated at about $18.1 million,[16] accounted for 9.5 percent of the gross national product estimated at $190 million. The Government's 4-year development plan (1967–70) called for an increase in diamond production to 640,000 carats worth $18.5 million in 1970. Increased diamond recovery was expected to result from the inauguration of a pilot field under Government control, and increased investment by two large diamond firms, to develop new workings and to raise efficiency at existing fields. A total of $7.9 million will be invested chiefly by private sources. A liberal investment code that grants substantial incentives and an Investment Guaranty Agreement with the United States has been enacted by the Government.

Production of diamond, the only significant mineral commodity, increased 1.7 percent compared with that of 1967. Local industry specialists report that it was almost impossible to estimate the quantity of gem stones recovered compared with industrial stones. In 1968 mining companies supplied about 10 percent of the total diamond output, whereas individual diggers supplied the bulk of production.

Exports of diamond in 1967 decreased 7 percent from that of 1966, owing mainly to the inclusion of December 1967 sales in 1968 export statistics. In 1968 diamond exports totaled 635,936 carats valued at $18.9 million compared with 513,184 carats in 1967 valued at $13.7 million. The United States (387,920 carats), Israel

[13] World Oil. V. 167, No. 3, Aug. 15, 1968, p. 188.
[14] Petroleum Intelligence Weekly. V. 8, No. 30, July 1969, p. 7.
[15] Prepared by Henry E. Stipp.
[16] Where necessary, monetary values have been converted from CFA francs to U.S. dollars at the rate of CFA francs 245 equals US$1.

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Table 8.—Central African Republic: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content troy ounces	75	28	48	---	---
NONMETALS					
Diamond, gem and industrial carats	442,281	536,810	539,935	520,628	609,360

[1] In addition, construction materials such as clay and sand and gravel were produced, but quantitative data were not available.

(190,781 carats), and France (57,234 carats) were the major buyers of CAR diamonds in 1968. CAR imports of mineral commodities in 1967 consisted mainly of petroleum refinery products valued at $1.9 million and iron and steel semimanufactured products valued at $900,000. The CAR had a favorable balance in mineral commodity trade although the balance in total commodity trade was unfavorable as shown in the following tabulation:

	Value (million dollars)	
	Mineral [1] commodity trade	Total commodity trade
Exports:		
1965	14.4	26.4
1966	16.5	r 31.0
1967	13.8	29.3
Imports:		
1965	3.6	27.4
1966	3.1	r 35.2
1967	4.3	44.5

r Revised.
[1] Values given are for only those commodities listed in table 9 of this chapter.

France and other European Economic Community countries remained the Central African Republic's main suppliers and customers, providing 79 percent of total imports and taking 48 percent of total exports. The United States purchased 30 percent of CAR exports composed mainly of diamonds. In April the Central African Republic announced its intention to withdraw from the Central African Customs and Economic Union (UDEAC), a customs union of five neighboring States (Cameroon, Central African Republic, Chad, Congo Brazzaville and Gabon). A new group the Union of Central African States (UEAC) was formed between Central African Republic, Chad, and the Democratic Republic of the Congo (Kinshasa).

Table 9.—Central African Republic: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
NONMETALS		
Diamond carats	552,451	[1] 513,184
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	304	434
IMPORTS		
METALS		
Aluminum	148	161
Copper	5	14
Iron and steel including alloys:		
Pig iron and ferroalloys	3	NA
Semimanufactures	2,725	4,068
Lead	2	1
Tin long tons	1	2
Zinc	---	---
NONMETALS		
Abrasives, natural	45	20
Cement, lime, and other building materials	18,402	20,742
Clay construction materials	118	145
Fertilizer materials, manufactured	1,201	3,844
Nonmetallic mineral manufactures	156	4,266
Other crude minerals	5,561	22
MINERAL FUELS AND RELATED MATERIALS		
Gas, natural or manufactured	270	352
Petroleum refinery products	32,032	34,882
Tar, pitch, and other crude chemicals from coal, oil, and and gas distillation	7	NA

NA Not available.
[1] Principal destinations: United States 291,559, Israel 144,020, West Germany 42,558.

Source: Statistical Office of the United Nations, Supplement to the World Trade Annual. V. 3, 1967, pp. 374–379.

In December the Central African Republic withdrew from UEAC and rejoined UDEAC.

The Central African Republic Government, the French Atomic Energy Commission (CEA), and Compagnie Française des Minierais d'Uranium signed an agreement in July to form a jointly owned mining company to exploit deposits of uranium minerals located about 97 miles

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east of Bangui. In 1967 the CEA assessed the reserves at 5,000 tons of uranium.[17] The agreement calls for an investment of about $32.6 million in plant, equipment, and improvement of overland communications between Bangui and Bakouma. The enrichment plant is expected to produce about 500 tons of uranium concentrate annually beginning in 1972.[18]

CHAD [19]

The mineral industry of Chad consisted primarily of natron (an impure compound of sodium chloride and sodium carbonate) recovery, although unrecorded quantities of salt and construction materials were produced for local use. Natron, recovered from the northeastern shore of Lake Chad, contributed negligible value to the gross national product estimated at $265 million [20] in 1967. Although the value of mineral commodities production is small compared to that of agriculture, which accounts for about 95 percent of the economy, the Government of Chad has adopted legislation designed to encourage minerals development. An investment code favorable to foreign investment and generous tax and customs benefits has been enacted.

Production of natron in 1968 decreased 55 percent from that of 1967, owing mainly to a decline in exports to Nigeria, Chad's largest customer. Recovery of natron in 1968 was valued at $82,855.

Trade in mineral commodities in 1967 consisted of natron exports valued at $163,000 compared with $176,000 in 1966. Chad also reexported petroleum refinery products valued at $130,000 in 1967 contrasted with reexports of petroleum products valued at $151,000 in 1966. Principal imports into Chad in 1967 were petroleum refinery products valued at $5.5 million; iron and steel semimanufactured products valued at $985,000, and cement, lime, and building materials valued at $791,000. Corresponding imports in 1966 were valued at $4.4 million, $857,000, and $545,000, respectively.

Total commodity trade in 1967 was composed of exports valued at $27.1 million and imports valued at $40.8 million. This compared with exports of $23.8 (revised) million and imports of $32.5 (revised) million in 1966. France was Chad's principal trading partner supplying 44 percent of imports and buying 57 percent of exports. The United States supplied 10 percent of Chad's imports consisting mainly of petroleum fuels and lubricants.

Table 10.—Chad: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Scrap, nonferrous	------	------
NONMETALS		
Natron	3,985	3,683
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	3,339	3,212
IMPORTS		
METALS		
Aluminum	5	9
Copper	6	9
Iron and steel:		
Pig iron and ferroalloys	5	NA
Semimanufactures	3,002	3,224
Lead	5	5
Zinc	1	1
NONMETALS		
Abrasives, natural	4	18
Cement, lime and other building materials	7,896	10,059
Clay construction materials	129	177
Fertilizers, manufactured	1,185	1,918
Nonmetallic minerals, crude, n.e.s.	3,112	2,178
Nonmetallic mineral manufactures	31	30
MINERAL FUELS AND RELATED MATERIALS		
Gas, natural or manufactured	146	217
Petroleum refinery products	29,534	41,887

NA Not available.

Source: Statistical Office of the European Communities. No. 6, 1968, pp. 39–49.

Chad's exports to United States were negligible. In April Chad became a member of the Union of Central African States (UEAC) and began trading with the Democratic Republic of the Congo (Kinshasa) another member of the union. Chad also announced its withdrawal from the Central African Customs and Economic Union (UDEAC) a customs union of five neighboring states.

[17] Mining Journal (London). Mining Annual Review. 1969, p. 327.
[18] U.S. Embassy, Bangui. State Dept. Airgram A–018, Feb. 14, 1969, p. 6.
[19] Prepared by Henry E. Stipp.
[20] Where necessary, monetary values have been converted from CFA francs to U.S. dollars at the rate of CFA francs 245 equals US$1.

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The French Bureau de Recherches Géologique et Minière was conducting a survey of platinum reserves for the Government of Chad.

A diamond cutting plant was being constructed in Fort Lamy. Chad does not produce diamond; therefore, stones for cutting will have to come from sources outside the country. The Government of Chad published a report including several maps describing and locating the principal mineral deposits in Chad.[21] Reportedly an important deposit of kaolin was discovered near Abou Deia. In June the Government granted the Erdis petroleum concession, in northeastern Chad to Louis Royer, a French national.[22]

CONGO (BRAZZAVILLE) [23]

The Congo (Brazzaville) mineral industry consists principally of the extraction of crude petroleum and the mining of small quantities of copper, gold, lead, tin, and zinc. The value of minerals output is small. In 1968 mineral commodity exports, excluding diamond originating mainly in the Democratic Republic of the Congo (Kinshasa), were valued at less than 0.6 percent of the gross national product, estimated at US$203 million.[24] Despite the low value of minerals output, mining should make a greater contribution to the economy in 1969, when the large deposit of potash, located at St. Paul, comes into production.

Significant mineral industry developments were the opening of the cement plant at Lautété; the potash mine, plants, branch railway line and port facilities at Pointe Noire were nearing completion; and the Congo Government granted two permits for petroleum and natural gas exploration to Entreprise de Recherches et d'Activités Petrolières (ERAP) and AGIP–SPA. Minerals research was being carried out in various areas of the country by the Congolese Mining Bureau and French and Soviet technicians under programs started in previous years.

Statistical data on production of mineral commodities in 1968 was not available; however, data on exports indicated that minerals output in general decreased somewhat compared with that of 1967.

Congo trade in mineral commodities outside of the Central African Customs and Economic Union in 1967 consisted principally of diamond exports valued at $16.1 million; crude petroleum and refinery products valued at $711,000, and nonferrous ore and concentrates valued at $1.0 million. In 1966 these mineral commodity exports were valued at $15.3 million, $862,000 and $730,000, respectively.

Imports of mineral commodities in 1967 were principally petroleum refinery products valued at $4.8 million; iron and steel

[21] Chaussier, Jean Bernard. Map of the Mineral Deposits of the Republic of Chad. Minister of Public Works, Postal Service and Telecommunications; Department of Mines and Geology, (Fort Lamy), Feb. 10, 1968, 62 pp.
[22] U.S. Embassy, Fort Lamy. State Dept. Airgram A–20, Feb. 1, 1969, p. 5.
[23] Prepared by Henry É. Stipp.
[24] Where necessary, monetary values have been converted from CFA francs to U.S. dollars at the rate of CFA francs 247 equals US$1.

Table 11.—Republic of Congo (Brazzaville): Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	[1] 1967	1968
METALS [2]					
Copper	NA	r 67	356	906	[3] 846
Gold, troy ounces	r 3,567	r 3,697	4,080	5,079	NA
Lead	2,169	r 2,961	2,648	1,408	[3] 400
Tin, long tons	34	44	48	53	[3] 25
Zinc	5,060	r 6,909	6,178	3,286	929
MINERAL FUELS AND RELATED MATERIALS					
Petroleum: Crude oil	82,506	70,987	61,922	53,714	[3] 48,714

r Revised. NA Not available.
[1] Source: International Monetary Fund. Surveys of African Economics. V. 1, 1968, p. 237.
[2] Mine output, metal content.
[3] Exports.

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semimanufactures valued at $3.4 million; and cement, lime, and building materials valued at $1.8 million. In 1966 the mineral commodity imports listed above were valued at $4.1 million, $2.6 million, and $958,000, respectively. The export of diamonds which entered the country through illicit channels contributed substantially to the nation's foreign exchange and helped to reduce its unfavorable balance of total commodity trade as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1965	22.0	46.8
1966	17.2	48.2
1967	19.1	47.5
Imports:		
1965	9.0	64.7
1966	9.0	69.6
1967	11.3	82.0

[1] Includes only those commodities listed in tables 12 and 13 of this chapter.

Table 12.—Republic of Congo (Brazzaville): Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel, including alloys:		
Scrap	968	1,222
Semimanufactures	4	478
Copper	944	4,267
Lead	6	15
Tin—long tons	39	57
Zinc	11,731	9,723
Nonferrous and concentrate	12,721	14,113
Nonferrous scrap	103	56
NONMETALS		
Diamond, gem—thousand carats	4,252	4,154
Cement, lime, and building materials	------	55
MINERAL FUELS AND RELATED MATERIALS		
Petroleum:		
Crude	65,182	38,400
Refinery products	11,103	11,846
Minerals, crude, unspecified	150	------

Source: Statistical Office and the European Communities. No. 6, 1968, pp. 113–117.

A cement plant located in the Lautété region, about 93 miles west of Brazzaville, was officially inaugurated in March. The plant was constructed with West German technical and financial assistance. Total cost of the plant was about $7.7 million,

Table 13.—Republic of Congo (Brazzaville): Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum	221	138
Copper	30	32
Iron and steel, including alloys:		
Pig iron and ferroalloys	100	NA
Unwrought	------	1
Semimanufactures:		
Bars, rods, sections	4,908	6,612
Plate, sheet, strip, hoop	4,188	6,409
Rails and accessories	884	10,350
Tubes, pipes, fittings	1,289	3,296
Other	97	189
Total	11,366	26,856
Lead	10	15
Tin—long tons	4	4
Zinc	10	9
NONMETALS		
Abrasives, natural	26	30
Cement, lime, and building materials	44,392	67,779
Clay construction materials	331	1,644
Fertilizer materials:		
Natural	2,295	148
Manufactured	7,067	5,607
Stone, sand, and gravel	212	176
Sulfur and pyrite	135	NA
Nonmetallic minerals, crude, unspecified	3,375	2,040
Nonmetallic mineral manufactures	82	635
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, and briquets	123	103
Petroleum refinery products	111,406	122,426
Gas, natural and manufactured	605	773
Tar, pitch and other crude chemicals from coal, oil, and gas distillation	6	5

NA Not available.

Source: Statistical Office of the European Communities. No. 6, 1968 pp. 103–112.

which was provided by the Federal Republic of Germany ($5.2 million) and two West German firms ($2.5 million). Twelve West German technicians will manage the plant for a period of 5 years and train Congolese nationals, who will take over operation of the plant. Production capacity of the plant was estimated at 80,000 tons per year, of which 50,000 tons will be consumed by Congo (Brazzaville). Surplus cement will be exported to neighboring countries.

The Compagnie des Potasses du Congo (CPC) mine, located in the Holle-St. Paul area about 28 miles northeast of Pointe Noire, was nearing completion of construction and development at yearend. The first shipment of potash was scheduled for mid-year 1969. CPC, the operating firm, is

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owned by the Government of Congo, Brazzaville (15 percent), Mines de Potasse d'Alsace and Bureau de Recherches Géologique et Minières (36.125 percent), and Société des Pétroles d'Afrique Equatoriale (12.75 percent). A total of $81 million has been invested in sinking a mine shaft, mining equipment, treatment facilities, power station and fuel line, branch railway line and wharf, and loading facilities at Pointe Noire. Funds have been provided as follows: Company capital $10.1 million, shareholders' contributions $25.9 million, World Bank loan $30.0 million, European Investment Bank $9.0 million, a consortium of banks led by National Bank of Paris $6.0 million.[25] A town containing 300 houses, a school, hospital, and other buildings has been constructed near the mine. An additional 150 houses have been obtained at Pointe Noire. Potash from CPC's mine will be marketed by Société Commerciale des Potasses et de l'Azote (SARL).

The Government of Congo (Brazzaville) granted the French firm Enterprise de Recherches et d'activitiés Petrolières (ERAP) and the Italian firm AGIP–SPA each permits to explore for crude petroleum and natural gas.[26] ERAP's permit area covers 1,583 square miles in the Pointe Noire vicinity. AGIP–SPA's area consists of two blocks 1,112 square miles and 206 square miles in the Madinga harbor vicinity. The permits are renewable two times for a period of 5 years each. ERAP agreed to spend the sum of $3.2 million in research during the first period, $2.4 million during the second period, and $1.6 million during the third period. AGIP–SPA agreed to spend during its three periods $2.4 million, $1.8 million, and $1.2 million, respectively. Taxes, royalties, and production bonuses to be paid to the Congo (Brazzaville) Government, if significant quantities of crude oil are found, also were stipulated.

DAHOMEY [27]

No mineral production was reported in the Republic of Dahomey in 1968. In 1967, exports of industrial diamond and manufactured fertilizers were both valued at $85,000;[28] other data were not available. The principal mineral commodities imported were iron and steel semimanufactures ($1,117,000), petroleum refinery products ($763,000), and cement, lime, and other building materials ($587,000).

Table 14.—Dahomey: Exports of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1966
METALS	
Aluminum, metal	15
Iron and steel, metal:	
Scrap	1,160
Semimanufactures	20
Lead, metal	7
Nonferrous metals, n.e.s	23
NONMETALS	
Cement, lime, and other building materials	11
Clay and clay products, including refractory brick	10
Nonmetallic minerals, crude, unspecified	64
Nonmetallic mineral manufactures	30
MINERAL FUELS AND RELATED MATERIALS	
Gas, natural and manufactured	2
Petroleum refinery products	81

[1] Data for 1967 are not available.

The discovery of oil in February 1968 was a significant event because the country has a dearth of mineral resources. Union Oil Company of Dahomey, a subsidiary of Union Oil Co. of California, found the oil in its first exploratory well, which was also the first in the country. The well is in 90 feet of water about 13 kilometers offshore and about 29 kilometers southeast of Cotonou. Several petroliferous zones were found at a depth of more than 7,000 feet; the individual flow rates from the zones were as much as 1,440 barrels per day. A second well was drilled about 1½ kilometers from the discovery well. Oil reserves are estimated at 20 million barrels.[29] The economic potential of the reserves was being evaluated.

During the year the Government extended Dahomey's territorial waters to 22 kilometers from the low water point. It also established a second zone extending 185 kilometers from the low water point as an

[25] Phosphorus and Potassium. Potash in the Congo (Brazzaville). No. 40, March/April 1969, pp. 42–45, 48.
[26] Industries et Travaux d'Outremer (Paris). No. 183, February 1969, p. 149.
[27] Prepared by Eugene R. Slatick.
[28] Where necessary, values have been converted from CFA francs at the rate of CFA francs 250 equal US$1.
[29] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 103.

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Table 15.—Dahomey: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal	34	38
Copper, metal, including alloys, all forms	6	46
Iron and steel:		
Semimanufactures:		
Bars, rods and sections	1,981	1,678
Plate, sheet and strip	3,122	2,644
Other	703	694
Total	5,806	5,011
Lead, metal, including alloys, all forms	13	NA
Tin, metal including alloys, all forms—long tons	1	NA
NONMETALS		
Abrasives, natural	3	NA
Cement, lime, other building materials	57,220	33,197
Clay and clay products (including all refractory brick)	564	444
Fertilizers, manufactured	2,786	6,207
Pigments, mineral	------	175
Sodium and potassium compounds: Caustic soda	------	368
Stone, sand and gravel	18	NA
Sulfur and pyrite	14	NA
Nonmetallic minerals, crude, unspecified	8,998	767
Nonmetallic mineral manufactures	25	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	2	NA
Gas, natural and manufactured	236	NA
Petroleum refinery products	39,658	26,500
Tar, pitch, and other crude chemicals	26	NA

NA Not available.

Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967.

area over which Dahomey has exclusive rights for mineral exploitation. Union Oil's concession extends to the 200-fathom line, which is about 24 kilometers offshore at most points.

The cement plant of Société des Ciments du Dahomey (SCD) was under construction at Cotonou. The plant will use imported clinker. Its output is expected to meet Dahomey's needs; some might be available for export.

ETHIOPIA [30]

The mineral industry continued to hold a minor place in Ethiopia's economy in 1968. Its contribution to the gross domestic product (GDP) was estimated to be the same as in 1967, when it accounted for about 0.3 percent of a GDP of $1.4 billion.[31] Investment in the mineral industry during 1966–67 (fiscal year ending July 7) totaled $5.9 million, including $3.3 million in petroleum and $2.2 million in potash.[32] The total compares with $5.8 million in 1965–66 and $9.6 million in 1964–65, the peak investment year. Ethiopia's third 5-year plan (1968–69 to 1972–73) projects an annual growth rate of 25 percent for the mineral industry; potash production is expected to reach 750,000 tons by the last year of the plan.

In 1968, production of most mineral commodities rose. The rise in gold production was due mainly to the completion of powerplants and water supply lines for the placer deposits in the Bore and Shanka valleys.[33] The petroleum refinery at Assab completed its first full year of operations, processing 3.4 million barrels of crude oil imported from Iran and Iraq. Manganese mining apparently stopped.

In 1967, salt continued to be the major mineral commodity exported, being valued at $448,000, or 86 percent of the total

[30] Prepared by Eugene R. Slatick.

[31] Where necessary, values have been converted at the rate of 1 Ethiopian dollar = US$0.40.

[32] Addis Abada. Statistical Abstract 1967 and 1968. Central Statistical Office, p. 53.

[33] World Mining. V. 5, No. 7, June 25, 1969, p. 140–141.

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Table 16.—Ethiopia: Production of mineral commodities [1]

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content--troy ounces--	e 27,300	24,236	[2] 21,256	r 22,943	38,828
Manganese, ore and concentrate	[3] 3,248	NA	NA	e 2,000	--------
Platinum, mine output, metal content--troy ounces--	e 180	353	318	282	349
NONMETALS					
Cement--thousand tons--	44	96	165	150	174
Clays, kaolin	e 500	e 200	e 7,000	7,540	13,000
Feldspar	10,000	NA	1,550	r 3,750	7,130
Gypsum and anhydrite, crude	e 4,000	e 2,500	5,000	6,103	360
Lime	[2] e 6,000	[2] e 4,000	26,909	22,337	22,735
Limestone	NA	NA	NA	132,033	147,155
Salt:					
Rock--thousand tons--	[2] 205	[2] 188	570	10	12
Marine--do--				250	250
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Motor gasoline--thousand 42-gallon barrels--	--------	--------	--------	296	603
Jet fuel--do--	--------	--------	--------	10	119
Distillate fuel oil--do--	--------	--------	--------	301	929
Residual fuel oil--do--	--------	--------	--------	NA	1,251
Liquefied petroleum gas--do--	--------	--------	--------	3	23
Asphalt--do--	--------	--------	--------	18	90
Total--do--	--------	--------	--------	NA	3,015

e Estimate. r Revised. NA Not available.
[1] Includes Eritrea.
[2] Data are for years ending September 10.
[3] U.S. imports.

Table 17.—Ethiopia: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Copper, scrap	------	35
Iron and steel: Scrap	55	20
Nonferrous scrap	103	180
NONMETALS		
Clay and clay products	4	16
Gypsum and limestone	12	10
Salt	165,523	156,480
IMPORTS		
METALS		
Aluminum, metal	433	586
Copper, metal	28	226
Iron and steel:		
Pig iron and ferroalloys, scrap	51	7,965
Semimanufactures:		
Bars	2,442	4,156
Plate and sheet	18,279	20,723
Hoop and strip	152	3
Tubes, pipes and fittings	7,751	58,563
Wire	3,759	3,415
Rails and accessories	636	1,319
Castings and forgings	143	104
Total	33,162	83,283

Commodity	1966	1967
IMPORTS—Continued		
METALS—Continued		
Lead, metal	------	64
Tin, metal	------	8
Zinc, metal	------	322
Nonferrous metals, n.e.s	2,310	1,000
NONMETALS		
Abrasives, natural	168	20
Chemicals, inorganic	825	5,768
Clay and clay products	1,978	1,381
Lime, cement, other construction materials	6,204	2,709
Salt	397	67
Stone, sand and gravel, dimension stone	88	296
Sulfur	3	71
Talc	------	15
Nonmetals, n.e.s	3,606	309
MINERAL FUELS AND RELATED MATERIALS		
Coal	9,125	765
Petroleum:		
Crude thousand 42-gallon barrels	------	1,091
Refinery products--do--	2,101	1,975
Tar, pitch, and other crude chemicals from coal, oil, and gas distillation	230	105

value of mineral exports. The principal destinations of the salt exports were Japan (128,181 tons), France (16,281 tons), and Malaysia (8,090 tons). The major mineral imports in 1967 were petroleum products, $9.8 million; iron and steel semimanufactures, $6.3 million; and crude oil, $2.6 million. The values of mineral trade and

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total trade for recent years are as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	0.4	113.2
1966	.5	107.6
1967	.5	100.0
Imports:		
1965	17.5	150.3
1966	18.9	161.7
1967	22.0	143.0

During the year the Ralph M. Parsons Co. relinquished its potash concession near Dallol, in northeastern Ethiopia. A concession north of Dallol was granted to Ethiopian Potash Co., a newly formed company consisting of Kaiser Aluminum and Chemical Corp. and Seatankers, Inc. A concession south of Dallol was granted to Salzdetfurth, a West German company.

Canadian companies reportedly were interested in the concession relinquished by Parsons, as well as in obtaining concessions for the following minerals:[34] Sulfur, at Dallol and Dofan; mercury, in Awash Valley and near Lake Langano; and diatomaceous earth, near Lake Langano.

The Duval Corporation of Tucson obtained leases to an alluvial platinum deposit at Yobdo, Wollega Province, and to copper deposits near Asmara, Ertrea. French and U.S. interests sought concessions for radioactive minerals in various parts of the country.

At yearend an offshore rig was drilling for Gulf Oil Company of Ethiopia near the Dahlac Archipelago; the total depth of the well will be about 11,000 feet. The well is Gulf's second; the first, which was unsuccessful, was drilled in 1966.

Late in the year Sabian Metal Products, Ethiopia, announced plans to build an electric welded steel pipe plant near its galvanized sheet plant near Addis Ababa.[35] The new plant would produce pipes ½ to 4 inches in diameter, and have a capacity of 1,000 tons per month working two shifts.

FERNANDO PO [36]

During the year offshore concessions were held by two companies. No discoveries were reported. Spanish Gulf Oil Company (Gulf Oil Company, 74.75 percent; Compania Española de Mines de Rio Tinto, 18.75 percent; Banco de Bilbao, 6.5 percent) had areas totaling 2,500 square kilometers northwest and northeast of the island. The company found traces of oil and gas in two wells drilled in the northwest in 1967. Mobil Producing Spain, Inc. (Mobil Oil Company, 40 percent; Compania Española de Petróleos, S.A., 40 percent; Compania Iberica de Prospeciones, 20 percent) had areas totaling 1,500 square kilometers north and northwest of the island. The company found traces of gas in a well drilled during the year. Near yearend concessions reportedly were granted to two other companies, but detailed data were not available.

THE FRENCH TERRITORY OF THE AFARS AND ISSAS [37]

As in previous years, there was no recorded production of mineral commodities; however, small quantities of construction materials such as clay, stone, and sand and gravel were probably produced for local use. Some salt also may be recovered by evaporation of sea water for local consumption.

Total imports of mineral commodities in 1967 were valued at about $1.0 million contrasted with $1.2 million in 1966. Total commodity imports in 1967 were valued at $19.0 million and $23.1 million in 1966. There were no mineral commodity exports recorded in 1967.

Trade in mineral commodities in 1967 consisted mainly of imports of iron and steel semimanufactured products valued at $389,000; petroleum refinery products valued at $391,000; and cement, lime, and

[34] Mining Journal (London). Mining Annual Review. June 1969, p. 311.
[35] Metal Bulletin. No. 5356, Dec. 10, 1968, p. 16.
[36] A province of the Republic of Equatorial Guinea as of October 1968. Prepared by Eugene R. Slatick.
[37] Prepared by Henry E. Stipp.

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building materials valued at $107,000. In 1966 the principal mineral imports consisted of petroleum refinery products ($750,000); cement, lime, and building materials ($201,000); and crude and partly refined petroleum ($98,000).

Table 18.—The French Territory of the Afars and Issas: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel: Metal:		
Castings and forgings	368	[1] 126
Semimanufactures	[r] 1,210	[2] 1,851
NONMETALS		
Cement, lime, etc	10,682	[1] 5,870
Nonmetallic minerals, crude, unspecified	652	[1] 207
MINERAL FUELS AND RELATED PRODUCTS		
Petroleum:		
Crude and partly refined	2,544	[1] 1,397
Refinery products	25,697	[1] 11,963

[r] Revised.
[1] Source: Statistical Office of the European Communities. Commerce Exterior. No. 5, 1968, pp. 198–203 (9 months 1967).
[2] Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 111, 124–127.

GAMBIA [38]

Gambia had no recorded production of mineral commodities in 1968; however, reportedly laterite and stone was quarried for local consumption. There was no indication of the value of this mining activity or its contribution to the estimated gross national product of $33 million [39] in 1967.

Gambia's trade in mineral commodities in 1967 consisted of exports of crude petroleum valued at $6.3 million and unwrought copper valued at $358,000. In 1966 exports of remelted copper were valued at $518,000. Imports of mineral commodities in 1967 were mainly iron and steel semimanufactures valued at $766,000, cement valued at $245,000, and manufactured mineral fertilizers valued at $209,000. In 1966 imports of the mineral commodities listed above were valued at $368,000, $179,000 and $68,000, respectively. Total commodity trade in 1967 consisted of $23.6 million in exports and $12.8 million in imports. Total commodity exports in 1966 were valued at $17.2 million and imports $12.4 million.

Table 19.—Gambia: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Copper, metal, unwrought	610	279
MINERAL FUELS AND RELATED MATERIALS		
Crude petroleum	------	389,117
IMPORTS		
METALS		
Copper, alloys, worked	------	24
Iron and steel: Semimanufactures	1,678	2,211
NONMETALS		
Cement	8,407	8,664
Fertilizers, manufactured	1,881	5,109
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	280	4,542
Bitumen	------	941

Source: Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 111–225.

GUINEA [40]

Guinea's mineral production consists of bauxite, alumina, diamond, gold, construction materials, and clay products. In 1968 as in the past several years, the only pro-

[38] Prepared by Henry E. Stipp.
[39] Where necessary, monetary values have been converted from Gambian pounds (£G) to U.S. dollars at the rate of £G1 equals US$2.40.
[40] Prepared by Eugene R. Slatick.

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duction data available were for bauxite and alumina. The total bauxite production includes 1,570,000 tons mined by Compagnie International pour la Production de l'Alumine (FRIA) at Kimbo and 549,000 tons mined by Harvey Aluminum, Inc. at Tamara Island. FRIA's production was converted into alumina; Harvey's was exported to its plant in the Virgin Islands, as it was in 1967.

Of the mineral commodities reported to have been exported in 1967, alumina and bauxite were the most important. A small amount of iron ore from stockpiles was exported to the United Kingdom. The chief mineral imports reported were aluminum and iron and steel semimanufactures.

During the year financial agreements totaling $110.5 million[41] were obtained by Compagnie des Bauxites de Guinée (CBG)

Table 20.—Guinea: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968
METALS					
Aluminum:					
Bauxite, gross weight thousand metric tons	1,678	1,870	1,609	1,639	2,118
Alumina, gross weight metric tons	484,350	522,142	525,310	529,980	580,861
Iron ore and concentrate thousand metric tons	908	755	• 1,600	---	---
NONMETALS					
Diamond:					
Gem carats	[1] 20,568	• 21,000	• 21,000	NA	NA
Industrial do	[1] 51,166	• 51,000	• 51,000	NA	NA

• Estimate. NA Not available.
[1] Exports.

Table 21.—Guinea: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Aluminum:		
Alumina	520,218	529,980
Bauxite	NA	33,015
Copper, scrap	---	26
Iron and steel:		
Ore and concentrate	338,345	14,711
Scrap	---	3,177
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	487	546
Copper	---	18
Iron and steel, semimanufactures	1,766	2,318
NONMETALS		
Cement, lime, etc	25,748	2,988
Clay and clay products	1,436	309
Fertilizers, manufactured	2,977	495
Stone and gravel	NA	NA
Nonmetals, n.e.s	13	15
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products thousand 42-gallon barrels	• 200	582

• Estimate. NA Not available.

for developing the large bauxite deposits at Boké. A $64.5 million loan was granted by the World Bank for development work, $25 million was from the Export-Import Bank for mining equipment, and $21 million was from the U.S. Agency for International Development (AID) for building a 126-kilometer railroad to the coast, a port, and related facilities. The total cost of the project is estimated at $182.5 million. A 5-year standby credit of $75 million has been arranged.

CBG is a joint venture comprised of the Government (49 percent) and Halco Mining, Inc. (51 percent). Halco's shareholders are Alcan Aluminum Ltd. (27 percent), Aluminum Company of America (27 percent), Harvey Aluminum Ltd. (20 percent), Compagnie Pechiney and Ugine-Kuhlmann (10 percent), Vereinigte Aluminium-Werke, A.G. (10 percent), and Montecatini Edison S.p.A. (6 percent).

Halco obtained the mining rights to the deposits in 1968. The deposits, located about 175 miles north of Conakry, are considered to be the world's most important undeveloped reserves of high-grade bauxite. Production is expected to begin in 1972 at an initial rate of 5 to 6 million tons per year, which will rank the country as one of the world's major bauxite producers. The participants of Halco have agreed to purchase the planned output

[41] Where necessary, values have been converted at the rate of 1 Guinea franc equals US$0.004.

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under a 20-year contract beginning in 1972.

Late in the year, after about 18 months of negotiations, the Government granted FRIA permission to undertake a $10 million expansion program that will increase its productive capacity from the present 530,000 tons per year to 700,000 tons per year by 1970. In addition to allowing FRIA to increase exports of alumina, the agreement also calls for increased Africanization of the company's labor force, which totals about 1,400, so that Africans comprise about 90 percent by 1970, as compared with about 80 percent in 1968. Ownership of FRIA is as follows: Olin Mathieson Chemical Corp. (48.5 percent), Compagnie Pechiney and Ugine-Kuhlmann (26.5 percent), Swiss Aluminium Ltd. (10 percent), and Vereinigte Aluminium-Werke, A.G. (5 percent).

The Government held discussions with Swedish, Italian, and United States mining companies regarding plans to develop the iron ore deposits near the Liberian border and at Simandou. The former deposits, an extension of the high-grade iron ore deposits in Liberia, contain about 200 million tons of ore. Reserves at Simandou, about 160 kilometers farther north, are estimated at up to 1,000 million tons. The shortest route to the coast from that part of Guinea is through Liberian territory.

The limestone deposits near the town of Mali, in northern Guinea, were being evaluated to determine their suitability to be processed by flotation methods. The deposits total about 5 million tons and are of low quality. A cement plant is envisaged for the area.

Deposits of feldspar, mica, quartz, and beryl were discovered by Hungarian geologists, who began prospecting in the country early in the year.

Late in the year the Royal Dutch/Shell Group was negotiating with the Government for a petroleum concession along the coast.

IVORY COAST [42]

Diamond remained the most important mineral in the Ivory Coast in 1968. The value of diamond production rose from $3.6 million [43] in 1967 to $3.8 million. Manganese, the only other mineral mined in significant amounts, declined in importance because of a continuation of low prices on the world market. Production in 1968 was valued at $1.7 million, down from $2.9 million in 1967. Together, these two industries had a labor force of 1,362 and, as of January 1, 1969, had invested a total of $14.9 million.[44] Other important sectors of mineral industry were two cement plants, which used imported clinker to produce cement valued at $9.8 million, and the petroleum refinery at Abidjan, which processed imported crude oil to make products valued at an estimated $18 million.

The preceding mineral commodities, together with iron and steel semimanufactures, were important trade items. By value, the chief mineral exports in 1967 were diamond, $3.6 million; manganese, $1.9 million; and petroleum products made from imported crude oil, $3.6 million. The chief mineral imports that year were crude oil, $12.2 million; iron and steel semimanufactures, $10 million; and cement, $4.1 million. The values of mineral trade and total trade for recent years were as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	8.8	277.2
1966	9.7	310.5
1967	9.5	327.5
Imports:		
1965	31.1	236.2
1966	33.2	257.6
1967	31.2	265.4

Of the three companies producing diamond, Société Anonyme de Recherches et d'Exploitation Minières en Côte d'Ivoire (SAREMCI) continued to rank first. It accounted for about 86 percent of the total output in 1968, as compared with 11 per- for Société Diamantifere de Côte d'Ivoire (SODIAMCI) and 3 percent for Société Minière des Bandamas (SMB). SMB's

[42] Prepared by Eugene R. Slatick.
[43] Where necessary, values have been converted from CFA francs at the rate of 1 CFA franc equals US$0.0041.
[44] Principales Industries Ivoiriennes Fin 1968. Chambre d'Industrie de Côte d'Ivoire, Juin 1969, p. 2.

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Table 22.—Ivory Coast: Production of mineral commodities [1]

Commodity	1964	1965	1966	1967	1968
METALS					
Columbium and tantalum, ore and concentrate, gross weight—kilograms	1,500	1,100	20	---	632
Gold, metal—troy ounces	---	---	---	116	84
Manganese, ore and concentrate, gross weight—metric tons	136,425	179,785	176,186	149,433	116,741
NONMETALS					
Cement—thousand metric tons	---	---	107	256	330
Diamond:					
Gem—carats	120,163	118,985	110,292	• 105,495	• 110,000
Industrial—do	80,108	79,323	73,528	• 70,330	• 77,009
Total—do	200,271	198,308	183,820	175,825	187,009
MINERAL FUELS AND RELATED MATERIALS					
Gasoline, motor—thousand 42-gallon barrels	---	---	1,183	1,251	1,358
Kerosine and jet fuel—do	---	---	535	579	625
Distillate fuel oil—do	---	---	1,242	1,341	1,470
Residual fuel oil—do	---	---	1,397	1,516	1,544
Liquefied petroleum gas—do	---	---	71	106	128
Total—do	---	---	4,428	4,798	5,125

• Estimate.
[1] In 1968 the following were also produced, in cubic meters: sand, 212,650; gravel ,156,117; granite, 44,533; laterite, 18,899; and clay, 11,824.

Table 23.—Ivory Coast: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Aluminum, metal, including alloys, all forms	224	373
Copper, metal, including alloys, all forms	2	1,061
Iron and steel:		
Scrap	6,320	4,441
Semimanufactures	614	514
Lead, metal including alloys, all forms	251	366
Manganese, ore and concentrate	177,028	105,587
Zinc, metal, including alloys, all forms	------	9
NONMETALS		
Abrasives, natural	------	1
Borates, concentrates	------	13,498
Cement	1,346	10,902
Clay, products (including all refractory brick)	41	34
Diamond—carats	178,215	178,516
Fertilizer materials, manufactured	465	1,982
Gypsum	------	36
Limestone	------	114
Mica	------	38
Salt	------	2,354
Nonmetallic minerals, crude n.e.s	4,762	105,589
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	30	16
Petroleum: Refinery products thousand 42-gallon barrels	r 2	1,410

r Revised.
[1] Source: Statistiques du Commerce Exterieur de la Côte D'Ivoire en 1967.

Table 24.—Ivory Coast: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Aluminum, metals, including alloys, all forms	1,866	2,246
Copper, metals, including alloys, all forms	118	142
Iron and steel:		
Scrap	4	43
Pig iron, ferroalloys and similar materials	14	4
Steel, primary forms, ingots and equivalent forms	2	3
Semimanufactures	46,456	170,385
Lead, metal, including alloys, all forms	74	191
Nickel, metal, including alloys all forms	1	6,527
Tin, metal including alloys, all forms—long tons	9	26
Zinc, metal including alloys, all forms	41	128
Nonferrous metals, n.e.s	1	1
NONMETALS		
Abrasives, natural	296	2
Cement	272,970	264,602
Chalk	------	368
Clay products (including all refractory bricks)	3,205	109
Fertilizer materials:		
Crude	128	2
Manufactured	26,315	21,081
Gypsum	------	8,931
Lime	------	3,014
Mica	------	3
Pyrite	14	------
Salt	------	24,175
Stone, sand and gravel	6,586	3,151
Talc, steatite	------	409
MINERAL FUELS AND RELATED MATERIAL		
Asphalt and bitumen, natural	------	1
Coal, coke and briquets	238	193
Petroleum:		
Crude thousand 42-gallon barrels	r 4,622	4,963
Refinery products—do	r 221	119

r Revised.
[1] Source: Statistiques du Commerce Exterieur de la Côte D'Ivoire en 1967.

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share was greater than that in 1967, when it was about 1 percent, even though about half of the plant feed had to be recycled, which caused the processing plant to shut down for about 1½ months at yearend. The amount of material treated and the average yield for these companies in 1968 were as follows: SAREMCI, 587,300 cubic meters, at 0.27 carat per cubic meter (ccm); SODIAMCI, 134,000 cubic meters, at 0.15 ccm; and SMB, 17,590 cubic meters, at 0.36 ccm. Société West African Selection Trust et Harry Winston (WASTON) continued prospecting; it might begin production in 1969. The French Bureau de Recherches Géologiques et Minières (BRGM) reportedly abandoned hopes of finding economic diamond deposits in the southeastern part of the country.

Manganese mining, which began in 1960 and reached a peak in 1965, continued to suffer from the effects of low prices for manganese on the world market. During the year the labor force of Compagnie de Mokta, the only manganese producer, was reduced from 371 to 233; the cutback included about half of the expatriates and about a third of the local personnel.

The iron ore deposits near Bangolo, southwest of Man, are to be evaluated by Pickands Mather & Company, which received prospecting rights to about 10,400 square kilometers in the western part of the country. Reserves of iron ore in the area total at least 400 million tons containing 35 to 40 percent iron. If economically exploitable deposits are found, the company will build a pelletizing plant at San Pedro; an annual production of 5 million tons of concentrates is envisaged. Total investment could reach $200 million. Late in the year, Industries Métallurgiques de la Côte d'Ivoire was granted a long-term loan to build a 12,000-ton-per-year rolling mill; an iron and steel plant are to be added later.[45]

In 1967 SODEMI permitted gold to be mined on its concession in the Issia region. Output was so small that the company stopped the mining operations in 1968.

Early in the year Société Ivoirienne des Engrais (SIVENG) awarded a contract to build a $6 million fertilizer plant that will have an annual capacity of 20,000 tons of ammonium sulfate and about 40,000 tons of granulated binary and ternary compounds.[46] The output will be mainly for domestic use, but some will be exported to neighboring countries. The major interests in SIVENG are the Government (33 percent), West Germany's Salzdetfurth A.G. (28 percent), and France's Société de Gestion et de Participation—SOGEPAR (28 percent), a holding company of Mines Domaniales de Potasse d'Alsace.

During the year, geologists of the United Nations Development Fund studied several anomalies found by aerial geophysical surveys, but the most encouraging were in the Monogaga region, southwest of Sassandra, where there are also strong geochemical anomalies of copper and molybdenum. A drilling program is planned for the area.

LESOTHO [47]

Diamond continued to be the only mineral that Lesotho produced and exported in significant amounts. Production in 1968 was valued at $527,000,[48] including $257,670 for gem diamond. That was a considerable drop as compared with 1967 levels, when production was valued at $1,434,848, including $1,001,854 for gem diamond. The decline was attributed to the cessation of digging by Basotho miners at the Letseng-la-Terai diamond field in June so that Rio Tinto Zinc Corp. (RTZ) could begin prospecting in the area. Also, the 1967 value included $302,904 that was obtained for the 601.25-carat "Lesotho Brown" diamond, the largest found in the country. Diamond export levies and registration fees provided the Government with about $70,000 in 1968, compared with about $196,000 in 1967.

Diamond production and exports are regarded as the same because further details are not available. Diamond exports in 1967 were valued at $1,434,848, compared with $976,087 in 1966. In 1966, the most recent year for which complete trade data are available, diamond ranked third by value among Lesotho's total exports, which were valued at $6,139,000. Reportedly,

[45] Metal Bulletin. No. 5346, Nov. 5, 1968, p. 15.
[46] Nitrogen. No. 57, January/February 1969, p. 16.
[47] Prepared by Eugene R. Slatick.
[48] Where necessary, values have been converted at the rate of 1 South African rand equals US$1.40.

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Table 25.—Lesotho: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968
Diamond:					
Gem—carats	726	2,777	r 3,868	4,682	1,604
Industrial—do	4,384	4,599	9,188	17,055	10,810
Total—do	5,110	7,376	12,506	21,737	11,914

r Revised.

some of the diamond exported from Lesotho was smuggled into the country from the Republic of South Africa; conversely, some of Lesotho's diamond is believed to be smuggled into South Africa. Imports in 1966 totaled $32,083,800 and included petroleum products valued at $1,450,400.

During the year RTZ entered into agreements with the Lesotho National Development Corp. (LNDC) and the Government that confirmed the 1967 agreement in principle that gave RTZ prospecting rights at Letseng-la-Terai. RTZ is obliged to spend $700,000 during its 2-year prospecting period, and about $8 million in developing costs if it decides to begin mining.

Other diamond fields being worked were Kao and Liqhobong. The Kao field was being surveyed by the Government so that it can control operations by issuing permits to Basotho applicants on behalf of LNDC. A diamond-buying office is planned for the area. London and Rhodesian Mining Co. applied for prospecting rights to an 85-square-mile area at Mothae, near Letseng-la-Terai.

In April, Lesotho Crushers Ltd. opened a $112,000 stone-crushing plant about 6 miles from Maseru. The plant supplies gravel for roads and construction work. Later in the year a section was added to produce precast concrete and cement bricks.

MALAGASY REPUBLIC [49]

The mineral industry of the Malagasy Republic was a minor contributor to the economy of the country in 1968. However, the startup of chrome mining near Andriamena, together with plans to develop bauxite deposits at Manantenina and to prospect for nickel and petroleum, indicated a greater role for minerals in the economic development of the nation. The United Nations Development Fund granted a credit of $245,500 to the Malagasy Republic for mineral resources studies and for investigation of underground water in the southern part of the island.

Production generally increased in 1968. The output of metals and minerals (excluding petroleum refinery products) was valued at about $2.3 million [50] in 1968, compared with $1.9 million in 1967. The output of graphite, the most valuable mineral commodity mined, rose 10 percent. Phlogopite mica production (all forms) continued to increase, principally because of larger production of splittings. Beryl production increased sharply, but was still far below the peak output of 411 tons recorded in 1963.

The Malagasy Republic continued to post an unfavorable balance of trade in both mineral commodities and total trade, as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1965	4.8	92.4
1966	5.2	98.5
1967	8.0	104.9
Imports:		
1965	20.0	139.5
1966	20.0	143.2
1967	18.0	146.5

[1] Values given are only for those commodities listed in tables 27 and 28 of this chapter.

[49] Prepared by Henry E. Stipp.

[50] Where necessary, values have been converted from Malagasy francs (FMG) to U.S. dollars at the rate of FMG 246 equals US$1.

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Table 26.—Malagasy Republic: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Beryl concentrate, gross weight	212	20	r 12	30	77
Bismuth concentrate, gross weight---kilograms	--------	--------	64	--------	40
Chromite, gross weight	11,770	2,384	--------	--------	--------
Columbite and tantalite, ores and concentrates, gross weight---kilograms	3,600	4,000	r 1,156	67	1,354
Gold, mine output, metal content---troy ounces	440	598	852	752	543
Rare-earth minerals:					
Bastnaesite concentrates, gross weight	(2)	--------	30	165	254
Betafite ores, gross weight---kilograms	20	35	--------	101	1,088
Euxenite ores, gross weight---do	191	20	--------	84	--------
Monazite concentrates, gross weight	964	1,085	850	25	(2)
Titanium, ilmenite concentrate, gross weight	r 4,900	6,311	6,188	1,857	--------
Uranium and thorium, uranothorianite, concentrate, gross weight [3]	690	421	359	307	--------
Zirconium, concentrate, gross weight	512	644	705	209	--------
NONMETALS					
Cement, hydraulic---thousand tons	r 43	39	r 51	60	68
Garnet, abrasive	65	69	12	(2)	50
Graphite, all grades	13,173	17,015	16,366	14,890	16,430
Kaolin	--------	3	13	120	620
Mica, phlogopite:					
Block	93	91	64	54	78
Splittings	589	538	653	482	725
Scrap	--------	--------	--------	205	103
Quartz, crystal	28	88	r 99	r 36	71
Salt, marine---thousand tons	r 23	r 12	r 13	14	17
Stone:					
Aragonite	--------	260	100	102	470
Ornamental	3	1	12	12	25
Jasper---kilograms	8,000	5,200	2,500	3,300	402
Stone, semiprecious---do	3,831	5,822	5,684	164	336
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous---thousand tons	4	2	--------	2	--------
Petroleum refinery products:					
Gasoline, motor---thousand 42-gallon barrels	--------	--------	NA	NA	865
Kerosine and jet fuel---do	--------	--------	NA	NA	372
Distillate fuel oil---do	--------	--------	NA	NA	809
Residual fuel oil---do	--------	--------	NA	NA	• 1,004
Liquefied petroleum gas (LPG)---do	--------	--------	NA	NA	70
Total refinery products---do	--------	--------	• 235	NA	• 3,120

• Estimate. r Revised. NA Not available.

[1] In addition to commodities listed, a variety of other minerals, mainly nonmetallic, are produced in very small quantities.

[2] Less than ½ unit.

[3] Exports.

Mineral commodity exports consisted chiefly of petroleum refinery products, valued at $4 million; graphite, valued at $1.8 million; and iron and steel semimanufactured products, valued at $517,428.

Principal mineral commodity imports in 1967 were iron and steel semimanufactured products, valued at $6.9 million; crude petroleum, valued at $4.6 million; petroleum refinery products, valued at $3.2 million; and hydraulic cement, valued at $1.3 million.

The trade regulations of the Malagasy Republic and the requirements for U.S. trade with Malagasy were reviewed in a U.S. Government publication.[51]

Bauxite deposits near Manantenina were scheduled for development by the French firm Compagnie Pechiney, according to an agreement with the Malagasy Government signed in April.[52] The deposit, which reportedly has reserves of 40 million tons of ore, was slated to be explored through 1970 at a cost of about $1 million.

Chromite deposits in the vicinity of Andriamena were being prepared for mining by Compagnie Minière d'Andriamena (COMINA). This organization is owned by the French firms Ugine-Kuhlman (55 percent); Pechiney (10 percent); Compagnie Financière pour l'Outre-Mer (10

[51] U.S. Department of Commerce. Foreign Trade Regulations of the Malagasy Republic. Overseas Business Reports, OBR 68-82, September 1968, 9 pp.

[52] Africa Report. Malagasy Republic. V. 13, No. 6, June 1968, p. 26.

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Table 27.—Malagasy Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Beryl concentrate	6	26
Chromite	1	------
Columbite and tantalite, ore and concentrate	1	------
Copper, metal, including alloys:		
Scrap	270	196
Semimanufactures	NA	1
Iron and steel:		
Scrap	166	4,837
Semimanufactures	1,585	2,002
Lead, metal, including alloys scrap	15	13
Tin, metal, including alloys, all forms	(1)	2
Uranium and thorium, ore and concentrate, including rare earths	1,398	829
Zinc, metal, including alloys, all forms	8	3
Other, ore and concentrate	NA	146
NONMETALS		
Garnet, abrasive	6	29
Cement, hydraulic	16	15
Graphite, natural [2]	16,815	16,199
Lime	2	4
Mica, all forms	961	861
Precious and semiprecious stones, except diamond----kilograms	104,433	48,476
Salt and brines	2,116	1,314
Stone, dimension	9	------
Other, n.e.s	8	------
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	5	------
Petroleum, refinery products thousand 42-gallon barrels	167	1,140
Mineral tar and other coal, petroleum or gas derived crude chemicals	2	1

NA Not available.
[1] Less than ½ unit.
[2] Principal destinations (1967): United States 4,370; France 3,920; United Kingdom 2,556; Japan 2,023.

percent); Compagnie de Mokta (5 percent); and the Malagasy Government (20 percent). COMINA's annual production capacity was reportedly 120,000 tons, but output was expected to rise to 200,000 tons in a few years.

Société Civile d'Étude et de Recherche du Minerai de Nickel à Madagascar (SOMINAD) was formed in Trananarive by a consortium to prospect for nickel.[53] SOMINAD is owned by Ugine-Kuhlmann (41 percent); Société Peñaroya (21.5 percent); Cofimer (12.5 percent); Omnium des Mines (7.5 percent); Anglo-American Corp. (7.5 percent); and the Malagasy Government (10 percent).

At yearend the Malagasy Government was expected to grant prospecting rights for 1 year to the Société Civile de Prospection de Nickel à Madagascar (PRONIMA). The firm is owned by Anglo-American Corp. (33 percent); Société Miniere et Métallurgique de Peñaroya (27 percent); the Malagasy Government (10 percent); and four other French companies (7.5 percent each). PRONIMA will explore for nickel, cobalt, chrome, manganese, copper, and tin in a 4,581-square-kilometer area west-northwest of Tananarive.

A cement plant located near Majunga was said to have a production capacity of 70,000 tons per year. The plant is owned by French and Belgian interests.

Exploration for petroleum and natural gas increased sharply in 1968. The Italian oil company Societa Per Azioni (AGIP), a subsidiary of Ente Nazionale Idrocarburi (ENI), obtained two permits in July to prospect an area of 21,000 square kilometers. The area extends along the west coast of Madagascar, north and west of the city of Majunga.[54] Continental Oil Overseas, a subsidiary of Continental Oil Co., Inc., and the Malagasy Government signed an agreement in June that committed Continental Overseas to explore for crude oil in southwestern Madagascar. Reportedly the company was conducting preliminary surveys in their 15,797-square-kilometer concession area onshore near Morombe. Frontier Petroleum Co., Inc., and Jack Grynberg Associates-Eason Oil Co., all U.S. firms, received grants from the Malagasy Government for oil exploration onshore and offshore along the southwestern coast, north and south of Tulear.[55]

Tenneco Oil Co., a subsidiary of Tenneco Corp., Inc., was granted two offshore exploration areas in eastern Madagascar, north and south of Tamatave, and in the southern section of the island, offshore and west of Fort Dauphin. Compagnie Française des Pétroles has been searching for oil and gas in a 32,000-square-kilometer area offshore from Morondava, granted to it in 1967. Société des Pétroles de Madagascar, a subsidiary of the French Government company Entreprise De Recherches Et D'Activités Pétrolières (ERAP), has been exploring for oil and gas in several onshore areas since 1950. At yearend 1968, the Israel National Oil Co. was negotiating with the

[53] Metal Bulletin. Madagascar Consortium. No. 5310, June 28, 1968, p. 27.
[54] Industries Et Travaux D'Outremer. No. 172, March 1968, p. 225.
[55] Oil and Gas Journal. Madagascar Exploration Spotlighted. V. 67, No. 14, Apr. 7, 1969, pp. 194–195.

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Table 28.—Malagasy Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	619	696
Copper, metal, including alloys, all forms	107	100
Gold, metal, unworked or partly worked	2,636	6,302
Iron and steel:		
Ore and concentrate	50	42
Metal:		
Scrap	20	649
Semimanufactures	33,276	35,638
Lead, metal, including alloys, all forms	263	213
Platinum, metal, including alloys troy ounces	1,125	353
Silver, metal, including alloys troy ounces	9,677	1,247
Tin, metal, including alloys, all forms—long tons	10	15
Zinc, metal, including alloys, all forms	105	110
Other, metals, including alloys, all forms	42	4
NONMETALS		
Abrasives, natural: Grinding and polishing wheels and stones	43	18
Cement	65,970	50,245
Chalk	352	315
Clays and clay products (including refractory brick):		
Crude clays, n.e.s	70	54
Products	1,152	291
Diamond, all grades thousand carats	175	20
Fertilizer materials:		
Crude: Phosphatic and other	498	415
Manufactured: Ammonia	29	32
Gypsum and plasters	2,379	3,514
Lime	2,743	2,248
Magnesite	8	1
NONMETALS—Continued		
Mica, crude and worked kilograms	2,313	120
Pigments, mineral, including iron oxides	104	22
Salt and brines	541	816
Sodium and potassium compounds:		
Caustic soda	237	339
Stone, sand and gravel: Dimension stone	2	2
Sulfur:		
Elemental	------	2
Sulfur dioxide	120	3
Sulfuric acid	------	80
Talc, steatite, soapstone and pyrophyllite—kilograms	77,292	32,003
Other nonmetals, n.e.s	553	3,150
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets	15,202	17,215
Coke and semicoke	72	70
Petroleum:		
Crude and partly refined	1,041	295,716
Refinery products:		
Gasoline thousand 42-gallon barrels	594	135
Kerosine and jet fuel thousand 42-gallon barrels	144	45
Distillate fuel oil—do	475	81
Residual fuel oil—do	16	63
Lubricants—do	40	51
Liquefied petroleum gas thousand 42-gallon barrels	23	4
Other—do	80	20
Total refinery products thousand 42-gallon barrels	1,372	399
Mineral tar and other coal, petroleum or gas derived crude chemicals	70	27

Malagasy Government for an offshore concession area in the northwest, between the towns of Analalava and Diego-Suarez.

A joint subsidiary formed by the French company Total and the United States company Texas Gulf Sulphur Co., Inc., will conduct exploratory work on a 52,000-square-kilometer area granted to Total's subsidiary, Compagnie des Pétroles Total (Madagascar).[56] Texas Gulf Sulphur was prepared to invest $2.4 million in the area.

MALAWI [57]

The only mineral commodity with recorded output in Malawi in 1968 was cement. About 55,500 tons were produced, compared with about 44,100 tons in 1967. In 1968 the mineral industry contributed about $480,000 [58] to a gross domestic product of about $204 million. Gems valued at $47,000 were the only mineral commodity reported to have been exported in 1967. The chief mineral imports in 1967 were iron and steel semimanufactures, which were valued at $877,000.

Geological mapping of the country was essentially completed by yearend 1968. Through geochemical prospecting, areas were located that could contain economic deposits of nickel, chromium, tin, zinc, copper, and gold. Other minerals reported in Malawi include apatite, pyrochlore,

[56] Petroleum Press Service. V. 36, No. 4, April 1969, p. 146.
[57] Prepared by Eugene R. Slatick.
[58] Where necessary, values were converted from Malawi pounds at the rate of 1 pound equals US$2.40 in 1968 and US$2.80 in 1967.

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Table 29.—Malawi: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, semimanufactures.	362	315
Copper, metal, semimanufactures and alloys.	20	77
Iron and steel, metal semimanufactures.	3,301	6,597
NONMETALS		
Cement	385	NA
Clay and clay products (including all refractory brick)	200	520
Fertilizer materials, manufactured	10,313	816
MINERAL FUELS AND RELATED MATERIAL		
Petroleum products thousand 42-gallon barrels	•454	•460

• Estimate. NA Not available.

rutile, and ilmenite. The bauxite deposit near Mlanje is expected to be exploited when electric power becomes available from the hydroelectric plant that is under construction at Cahora Bassa, on the Zambezi River in Mozambique.

The monazite deposit at Kangankunde Hill was found to contain a higher content of europium than expected. The ore contains 5 to 6 percent monazite. The surface deposits can be mined by open-pit methods to yield at least 110,000 tons of monazite.[59] London and Rhodesian Mining Company has the mining rights.

R. W. Gunson (Exports) Ltd. plans to begin mining sapphire and ruby in 1969.[60] The gem deposits, which were found in 1967, are about 100 kilometers northwest of Blantyre. During the year the company purchased rough gems from Malawi and elsewhere for cutting and polishing.

The copper deposits discovered in 1964 at Makoko, southwest of Nsanje, were being developed by Makoko Copper Company. Although two small smelters were installed during the year, commercial production had not yet begun. The copper is mined by hand. When the smelters are in operation, the labor force totals about 100. The investment in the operation totals about $40,000, including about $8,000 from Otavi Mining Company, a South African firm.

The first local petroleum marketing company, Oil Company of Malawi Ltd. (OILCOM), was formed during the year. It is owned by the Government's Farmers Marketing Board (20 percent) and private Portuguese interests (80 percent). Products are obtained from the refinery near Lourenço Marques, Mozambique. The company has several filling stations and a Government contract to supply petroleum products in the northern part of the country. Storage depots are to be built at Nkhata Bay, Mzuzu, and possibly at Mzimba and Karonga.

Shell (Malawi) Ltd. built a liquefied petroleum gas (LPG) filling plant and two 170-barrel-capacity LPG storage tanks at Blantyre. These facilities enable LPG to be imported in rail tankcars instead of in cylinders.

MALI [61]

The mineral industry of Mali consisted principally of the production of marble and salt, which contributed negligible value to the gross national product estimated at $347 million [62] in 1968. Although Mali's output of mineral commodities was small, the Government has been exploring for mineral and petroleum resources with the help of French and Soviet technicians. The British and United States company, Selection Trust Ltd., after surveying for diamonds in the Kenieba region for the last 3 years, failed to find sufficient reserves for commercial exploitation. An Investment Guaranty Agreement has been in effect between the United States and Mali since 1964, but no guarantees have been issued. U.S. firms are not active in Mali except for Mobil Oil of West Africa and Texaco Africa Ltd., which sell petroleum products.

Gold was mined in the Kenieba area, but the quantity produced was not recorded. Prospecting for gold also was

[59] Industrial Minerals. No. 14, November 1968, p. 19.
[60] Standard Bank Review (London). February 1969, p. 26.
[61] Prepared by Henry E. Stipp.
[62] Where necessary, monetary values have been converted from Mali francs (MF) to United States dollars at the rate of MF493 = US$1.

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carried out on a sporadic basis in the districts of Yanfolila, Kangaba, and the Adrar of Ifaras. Marble was quarried in the Bafoulabe area at the rate of 2,500 tons annually. The marble was used to make 600 tons of marble chips, 500 tons of powder, and about 21,500 square yards of marble slabs. Salt was produced mainly in the Taoudenit basin of northern Mali. Reportedly the area contains an estimated 23 million tons of salt of 99 percent purity. Estimated production in 1968 ranged from 3,000 tons to 3,500 tons. Transportation of salt to markets is a problem preventing exploitation of the resource. The basin is about 500 miles north of Tombouctou.

Mali's trade in mineral commodities in 1967 consisted of exports of crude nonmetallic minerals valued at $98,000; reexports of scrap and ferroalloys valued at $56,000; and petroleum products valued at $31,000. In 1966 exports of nonmetallic minerals were valued at $146,000. Most of Mali exports went to neighboring countries—mainly Mauritania. Imports of mineral products in 1967 consisted mainly of petroleum products valued at $3.9 million, iron and steel semimanufactured products valued at $1.5 million, and cement, lime, and building materials valued at $1.4 million. In 1966, imports of these commodities were valued at $2.3 million and $1.0 million, respectively. The relationship of mineral trade to total trade is shown in the following tabulation:

	Value (thousand dollars)	
	Mineral commodity trade [1]	Total commodity trade [2]
Exports:		
1965	156	15,706
1966	219	13,100
1967	185	16,500
Imports:		
1965	5,592	42,916
1966	4,981	35,950
1967	8,364	51,718

[1] Includes only those commodities listed in tables 30 and 31 of this chapter.
[2] Includes only trade under control of customs service; does not include imports of equipment for various aid projects and substantial uncontrolled trade with neighboring countries.

Reportedly, 500 million tons of 4.0 to 6.5 percent copper, lead and zinc ore were estimated to occur in the Kita area, west of Bamako. Reserves of iron in the regions of Bafoulabe and the Mandingue Plateau have been evaluated at more than 1 billion tons, of which 500 million tons has an iron content of 56–60 percent.[63] Société Nationale de la Recherche Minière (SONAREM) was prospecting for phosphate rock in the Bourem area near Gao. SONAREM, with the help of U.S.S.R. technicians, was exploring for petroleum in northern Mali in the Inesserine and Sudan basins.

Table 30.—Mali: Exports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966 [1]	1967 [2]
METALS		
Iron and steel, including alloys:		
Scrap and ferroalloys	-----	7
Semimanufactures	3	-----
NONMETALS		
Cement, lime, and other building materials	24	-----
Nonmetallic minerals, crude, n.e.s.	1,075	671
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	32	140

[1] Statistical Office of the European Communities. No. 4, 1967, pp. 35–45.
[2] Statistical Office of the European Communities. No. 5, 1968, pp. 129–146.

Table 31.—Mali: Imports of selected mineral commodities

(Metric tons unless otherwise sepcified)

Commodity	1966 [1]	1967 [2]
METALS		
Aluminum	96	56
Copper	3	23
Iron and steel, including alloys:		
Scrap and ferroalloys	65	22
Semimanufactures	5,450	3,575
Lead	1	38
Tin	1	NA
NONMETALS		
Abrasives, natural	2	------
Cement, lime and other building materials	39,032	29,972
Clay construction materials	182	423
Fertilizers, manufactured	75	1,131
Stone, sand and gravel	106	4
Nonmetallic minerals, crude, unspecified	20,854	16,422
Nonmetallic mineral manufactures	11	117
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, briquets	37	18
Gas, natural and manufactured	259	265
Petroleum refinery products	74,439	82,096

NA Not available.
[1] Statistical Office of the European Communities. No. 4, 1967, pp. 35–45.
[2] Statistical Office of the European Communities. No. 5, 1968, pp. 129–146.

[63] Industries Et Travaux D'Outremer (Paris). No. 172, March 1968, p. 217.

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MAURITANIA [64]

The mineral industry of the Islamic Republic of Mauritania consisted of iron ore mining in the Fort Gourand area and the output of monazite ore at a mine near Bou-Naga. In addition Mauritania also produced small quantities of salt and crude nonmetallic minerals such as clay, stone, and sand and gravel. Production of these mineral commodities, which was valued at an estimated $50.0 million,[65] contributed 37 percent to the gross national product estimated at about $136 million in 1968. The principal mineral activity was centered in the vicinity of Akjoujt where the Société Minière de Mauritanie (SOMIMA) was developing its copper mine and ancillary facilities. In order to exploit its copper deposit SOMIMA borrowed $20 million from the International Financial Corp. and $11 million from the European Investment Bank. The Mauritanian Government also is supplying a substantial part of SOMIMA's equity capital. Development of the mine, plants, and other additional facilities was estimated to cost about $60 million. The Government and SOMIMA contributed to the construction of a 155-mile tarred road from Akjoujt to Nouakchott, which was scheduled for completion by 1970. A water supply system and a modern township also were to be constructed. The Government planned to expand shipping facilities at Nouakchott and improve shore installations at the port. Development of the deposit at Akjoujt and ancillary facilities will make a significant contribution to the economy of Mauritania.

Production of iron ore increased 3 percent to a record high, compared with that of 1967. The increase in output was made possible by exploitation of a recently developed deposit at F'Derick. Iron ore production was valued at an estimated $50 million, down somewhat from 1967 production owing to a decrease in the price of ore in world markets. Mining of rare-earth minerals near Bou Naga, which began in 1968, occurred during 6 months of the year. It was impracticable to operate the mine during the rainy or hot seasons. Output was expected to reach 1,000 tons per year, when the mine was fully developed. Production of copper concentrate at the mine near Akjoujt was expected to begin in 1970.

Mauritanian trade in mineral commodities consisted mainly of the export of iron ore valued at an estimated $63 million in 1967. Reexport of petroleum refinery products to neighboring countries was valued at more than $70,000. Imports of mineral commodities in 1967 were principally iron and steel semimanufactured products valued at $1.7 million and petroleum refinery products valued at more than $964,000. In 1966 these commodities were valued at $1.4 million and $1.2 million, respectively. The relationship of trade in mineral commodities to total commodity trade is shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1965	54.1	57.6
1966	64.4	69.2
1967	63.8	90.0
Imports:		
1965	2.8	23.8
1966	3.3	22.4
1967	3.7	30.5

[1] Includes only those commodities listed in tables 33 and 34 of this chapter.

[64] Prepared by Henry E. Stipp.
[65] Where necessary, monetary values have been converted from CFA francs to U.S. dollars at the rate of CFA francs 247 equal US$1.

Table 32.—Mauritania: Production of mineral commodities

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Iron ore and concentrate—thousand metric tons	5,080	6,284	7,157	7,452	• 7,700
Rare-earth metals, monazite ore, gross weight metric tons	-------	-------	-------	-------	570
NONMETALS					
Salt, marine (including other evaporated)—do	600	600	NA	NA	NA

• Estimated. NA Not available.
[1] In addition to commodities listed, construction materials such as gypsum, clay, sand and gravel are produced, but quantitative data are not available.

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Table 33.—Mauritania: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Iron and steel:		
Ore and concentrate thousand tons	7,135	[2] 7,532
Metal, scrap	1,285	1,309
Tin long tons	1	[3] 2
Other nonferrous metals	1	NA
NONMETALS		
Nonmetallic minerals, crude, unspecified	3,700	[3] 3,074
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	5,962	[3] 6,386
Gas, natural and manufactured	2	NA

NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 355–359.
[2] Principal destinations in thousand tons: United Kingdom 1,658; France 1,644; West Germany 1,253; Italy 1,197.
[3] Statistical Office of the European Communities. Commerce Exterieur. No. 5, 1968, pp. 114–126 (9 months 1967).

Table 34.—Mauritania: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Aluminum	11	[2] 97
Copper	24	94
Iron and steel semimanufactures	7,333	8,775
Lead	3	NA
Tin long tons	8	[2] 19
Zinc	3	NA
Other nonferrous metals	6	NA
NONMETALS		
Cement, lime, etc	6,266	[2] 6,030
Clay, and clay products	137	[2] 95
Fertilizers, manufactured	2,326	2,372
Pigments	------	111
Salt	------	1,992
Stone, sand and gravel	97	[2] 41
Other crude mineral products	131	1,911
Nonmetallic mineral manufactures	16	[2] 62
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	384	[2] 4
Gas, natural and manufactured	279	NA
Petroleum refinery products	45,085	[2] 84,102

NA Not available.
[1] Statistical Office of the United National Supplement to the World Trade Annual. V. 3, 1967, pp. 355–359.
[2] Statistical Office of the European Communities. Commerce Exterieur. No. 5, 1968, pp. 114–126 (9 months 1967).

The Société des Mines de Fer de Mauritanie (MIFERMA) was the most important single industrial enterprise in Mauritania. Revenues from the iron ore mining and shipping complex financed one-third of the Government's budget. In January President Moktar Ould Daddah inaugurated a new ore field at F'Derick in the Fort Gourand region. MIFERMA has invested $20.4 million to improve the mine and ancillary facilities at F'Derick, which will permit production of 1.5 million tons of ore annually. Proved reserves at this field total 21 million tons of high-grade ore. It was reported that since 1960 MIFERMA has paid more than $26.7 million to the Government. During the same period more than 1,200 Mauritanians were given special training in mining and in equipment operation. Also 20,000 persons not employed by the company were treated in the firms medical clinics, while 1,300 were hospitalized, which indicates MIFERMA's social contributions to Mauritania.

The Guelb Moghrein copper deposits, which are being developed by SOMIMA, are located about 5 miles west of Akjoujt in western Mauritania. The ore occurs in the form of oxides of copper and iron overlying copper sulfides. Reportedly SOMIMA plans to mine the copper oxide ore body initially. Oxide ore will be treated by the Torco process, which has been patented and used on refractory copper ore by Anglo American Corp. in Zambia. The process consists essentially of heating crushed ore, salt, and coal (or a carbonaceous material) in a kiln to temperatures between 740° and 810° C. The resulting metallic copper particles are recovered by flotation.[66] The mine and associated plant was scheduled to produce 90,000 tons of copper concentrates annually at full capacity.

Société d'Exploitation Minière et de Recherches de Mauritanie (SOMIREMA), a subsidiary of Pechiney-Saint-Gobain (80 percent) and the Government of Mauritania (20 percent), was exploiting a deposit of monazite near Bou Naga, about 90 miles southeast of Akjoujt. Reportedly the ore contains from 1 to 3 percent rare-earth oxides and yttrium. The open-pit mine will be worked for 6 months of the year, owing to poor working conditions during the rainy or hot seasons.

Reportedly a phosphate rock deposit with reserves of 4 million tons was to be mined on a small scale to supply local

[66] U.S. Consulate, Johannesburg. State Dept. Airgram A-83, Mar. 26, 1969, p. 1.

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requirements.[67] The Deposit was said to be located in the Senegal River Valley between Matam and Kaedi.

In mid-November Amoco Mauritania Petroleum Co. started drilling the first oil well in Mauritanian waters, about 25 miles north-northwest of Nanakchott.[68] Amoco Mauritania has a majority interest in a 15,000 square mile concession held jointly with Planet Oil Corp. In December the drilling vessel was moved a short distance and a new well was started. The depth of water in the drilling area is about 250 feet.

NIGER [69]

The Republic of Niger mineral industry was characterized mainly by the output of tin concentrates and common construction materials for local consumption. Mineral production contributed insignificant value to the gross national product, estimated at $323 million in 1968.[70] Uranium production, scheduled to begin in 1970, should make a significant contribution to Niger's economy. Creation of new industries in Niger has been slow, although a new liberal investment code was enacted in July 1968.[71] Probably the most important industrial investment in Niger to date has been the cement plant at Malbaza. Niger and the United States have an Investment Guaranty Agreement in force; however, investment by U.S. firms and individuals has been small. As a member of the West African Customs Union and an associate member of the European Economic Community (EEC) Niger is heavily dependent on France and the EEC for development financing.

No new mining and petroleum laws have been passed recently. The Mining Code of May 1961 and the Petroleum Code of May 1964 are still in force.

The United Nations Special Fund program for a water development survey near Zinder came to a close in mid-1968. Since 1967 the United Nations has had a program to assist the Government in the evaluation of mineral resources in the Liptako and Air areas and of coal resources near Agadès, and in the training of Niger citizens in mineral exploration and evaluation. Mineral studies of the Liptako area were concentrated on geochemical prospecting. A detailed study of gold anomalies in the Sirba Valley and of manganese near Tera was scheduled for the first year. Mineral investigation in an area south of Air consisted of geochemical analysis and statistical studies of granitic massifs to determine metalliferous zones in the granites. Studies on coal seams northwest of the coal deposit of Tchirezrine were scheduled to commence with a drilling program at yearend 1968. The French Atomic Energy Commission was prospecting on a renewed 5-year permit in the Elrhaz area near Agadez. Société Minière du Niger and the Government continued prospecting for gypsum in the Inaridal region northwest of Agadez where interesting indications have been discovered.

Production of mineral commodities in 1968 consisted principally of cement valued at $1.5 million and tin concentrates valued at $303,429. In 1967 output of these commodities was valued at $1.3 million and $159,000, respectively. Construction materials and a small quantity of gold was also produced.

Statistics on trade in 1967 were mainly incomplete. Exports of tin concentrates and imports of petroleum refinery products and iron and steel semimanufactures were the principal mineral commodity items traded by Niger. Exports of tin concentrates (all to Nigeria) were valued at $159,184 in 1967 compared with tin concentrate exports estimated at $170,000 in 1966. Imports of petroleum refinery products (3 months 1967) were valued at $527,000 and iron and steel imports were valued at $754,000. Petroleum refinery products and iron and steel semimanufactures imported in 1966 were valued at $3.8 million and $909,000, respectively.

The Société Des Mines De l'Air (SOMATR) signed a contract with the French firm Ugine-Kuhlmann for construction of the uranium concentration plant at Arlit. Reportedly the electric power sta-

[67] Phosphorus and Potassium. No. 26, December 1966, p. 7.
[68] World Petroleum Report. V. 15, 1969, p. 101.
[69] Prepared by Henry E. Stipp.
[70] Where necessary, CFA francs have been converted to U.S. dollars at the rate of CFA francs 247 equals US$1.
[71] Industries Et Travaux D'Outremer. Niger: A New Code of Investments. No. 180, November 1968, pp. 1015–1016.

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Table 35.—Niger: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content--troy ounces--	--------	--------	64	51	56
Tin:					
Concentrate, gross weight-------long tons--	74	77	r 82	79	100
Concentrate, metal content----------do----	48	53	r 57	55	70
NONMETALS					
Building stone----------cubic meters--	455	604	480	748	NA
Cement----------thousand tons--	--------	--------	15	22	23
Clay, common----------do----	--------	--------	1,790	2,940	NA
Gravel----------cubic meters--	4,822	3,020	14,105	4,211	NA
Gypsum----------metric tons--	--------	1,500	r 925	r 1,588	1,957
Limestone----------do----	NA	NA	22,834	r 31,287	NA
Salt----------do----	NA	NA	NA	• 4,500	NA
Sand----------cubic meters--	4,207	11,663	7,576	4,214	NA

• Estimate. r Revised. NA Not available.

Source: Ministère Des Travaux Publics, Des Transports Des Mines Et De L'Urbanisme, Rapport Annuel 1967, 98 pp.

Table 36.—Niger: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
EXPORTS		
METALS		
Iron and steel, semimanufactures---	10	NA
Tin, ore and concentrate long tons--	r 82	80
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products--------	2,565	NA
IMPORTS		
METALS		
Aluminum, metal----------	290	[2] 40
Copper, metal----------	11	[2] 11
Iron and steel, semimanufactures---	3,529	5,066
Lead, metal----------	1	NA
Tin, metal----------long tons--	1	NA
Zinc, metal----------	-----	400
Nonferrous metals, ore and concentrate, unspecified---------	1,055	NA
NONMETALS		
Cement, lime etc----------	6,619	178
Clay and clay products including refractory brick----------	556	[2] 40
Fertilizer materials, manufactured--	485	[2] 181
Pigments----------	-----	262
Salt----------	8,283	NA
Stone, sand and gravel----------	192	NA
Nonmetallic minerals, crude unspecified----------	8,297	[2] 9,079
Nonmetallic mineral manufactures--	21	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets----------	268	NA
Gas, natural and manufactured-----	226	[2] 80
Petroleum refinery products--------	44,018	[2] 5,860
Tar, pitch, and other crude chemicals from coal, oil, and gas distillation-	5	NA

r Revised. NA Not available.

[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 360–364.

[2] Statistical Office of the European Communities. Commerce Exterieur. No. 1, 1968, pp. 122–133 (3 months 1967).

tion at Arlit, consisting of two diesel motors each producing 700 kilowatts, started to operate in July. About 1 million tons of overburden has been removed at the site of the open-pit mine. Houses and dispensaries were almost completed and 1,000 persons were living at Arlit at yearend 1968. The mine and beneficiation plants are scheduled to begin producing at 200 tons a year by 1970 and reach output capacity of 1,000 tons a year by 1974.[72]

[72] Mining Annual Review (London). June 1969, p. 325.

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RIO MUNI [73]

During the year, Spanish Gulf Oil Company and Compania Española de Petróleos, S.A., drilled the first well on jointly held 1,200-square-kilometer concession off the southwest coast. No discoveries were reported. The Spanish Government invited bids for five exploration areas off the west and northwest coasts, and Standard Oil Company applied for four of them.

RWANDA [74]

No developments were reported in Rwanda's mineral industry in 1968. Mining activity reportedly was being hampered because the mining law tends to promote small-scale mining operations.[75] Smuggling continued to plague the industry; an estimated 25 percent to 30 percent of the cassiterite produced is believed to be smuggled out of the country.[76] Cassiterite miners received wages of about $0.45 [77] per day, as compared with about $0.35 for manual laborers in the Kigali area.

Cassiterite remained the chief mineral produced and exported. Cassiterite production in 1968 was valued at an estimated $3.3 million, compared with an estimated $3.7 million in 1967. Out of a total export trade value of $14 million in 1967, mineral exports accounted for $5.3 million, including $4.2 million for cassiterite. Cassiterite was the country's second most important export item after coffee.

Based on available data, the chief mineral commodities imported in 1967 were cement, $6.5 million, and petroleum products, $1.2 million. Imports of all commodities were valued at about $20 million.

The two chief tin mining companies were MINETAIN, which accounted for 47 percent of the 1968 output, and Société Minière de Muhinga et de Kigali (SOMUKI), which accounted for 28 percent. MINETAIN, the largest of the nine mining companies in Rwanda, also accounted for 19 percent of the tungsten produced and for all the columbium-tantalum and beryl. The numerous individual miners produced about 12 percent of the cassiterite and 28 percent of the tungsten.

[73] A province of the Republic of Equatorial Guinea as of October 1968. Prepared by Eugene R. Slatick.
[74] Prepared by Eugene R. Slatick.
[75] Mining Journal (London). Mining Annual Review. June 1969, p. 310.
[76] Work cited in footnote 75.
[77] Where necessary, values have been converted at the rate of 1 Rwanda franc equals US$0.01.

Table 37.—Rwanda: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Beryl concentrate, gross weight	298	[2] 151	133	109	148
Columbium and tantalum, ore and concentrate, gross weight	29	50	25	31	28
Gold, mine output, metal content—troy ounces	NA	NA	106	3	NA
Lithium minerals, amblygonite	295	-------	NA	NA	NA
Tin:					
Ore and concentrate [3]—long tons	2,020	2,006	1,855	1,929	1,719
Content of concentrate—do	1,360	• 1,424	• 1,340	• 1,393	• 1,238
Tungsten, ore and concentrate	138	253	363	538	624
MINERAL FUELS AND RELATED MATERIALS					
Natural gas—million cubic feet	-------	35	NA	NA	NA

• Estimate. NA Not available.
[1] In addition to commodities listed, construction materials such as clay, sand and gravel are also produced, but quantitative data are not available.
[2] United States imports.
[3] Includes small quantity of mixed cassiterite-columbite-tantalite concentrate.

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Table 38.—Rwanda: Principal mineral commodity trade

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Beryl ore, and concentrate	r 180	170
Columbium and tantalum, ore and concentrate	r 93	58
Tin, ore and concentrate long tons	r 1,776	2,112
Tungsten, ore and concentrate	r 382	647
IMPORTS		
METALS		
Aluminum, metal, including alloys all forms	46	42
Iron and steel, semimanufactures	1,858	1,248
NONMETALS		
Cement	r 10,364	13,426
Salt	r 5,865	6,271
MINERAL FUELS AND RELATED MATERIALS		
Petroleum products	r 12,681	13,435

r Revised.

Sources: Bulletin de Statistique, République Rwandaise. No. 13, April 1967; No. 16, January 1968. Statistical Office of the United National Supplement to the World Trade Annual. V. 8, 1967, pp. 460–462.

SENEGAL [78]

The mineral industry of Senegal generally experienced a satisfactory year; however, production of phosphate rock, the country's principal mineral commodity, was down slightly from that of 1967. Minerals output (including mineral fuels) was valued at an estimated $20.6 million, contributing about 2.8 percent to the nation's gross domestic product estimated at 713.7 million in 1968.[79]

The Senegalese Minister of Finance and the French Secretary of State for Cooperation signed a convention for a $104,000 loan to cover mineral prospecting in Senegal's Miokola-Koba area. The Government of Senegal also instituted a petroleum code similar to the Saharan Petroleum Code. Provisions of the code were as follows: Ordinance 60–24 of 10 October 1960, its applying Decree 64–261 of 24 March 1964 and Decree 64–363 of 20 May 1964, pertained to approving a model concession and determining the legal and fiscal regime for exploration, exploitation, and transportation of hydrocarbons.

Exploration for mineral deposits was being conducted by the Government with United Nations assistance. The French organization Bureau de Recherches Géologiques et Minières (BRGM) reportedly spent $182,297 on exploration work in the Kedongan region in 1968.

Production of phosphate rock decreased somewhat as a result of continuing competition in world markets, despite a rise in prices to their previous levels. Compagnie Sénégalaise Des Phosphates De Taiba (TAIBA) had a good year, although part of the workings at the N'Domour Diop deposit collapsed, owing to the introduction of new mining methods. In late 1968 the company obtained six 100-ton trucks, which will be used to transport ore to the processing plant. Production capacity will be increased to 1.5 million tons per year by October 1969. Currently phosphate ore is transported to the plant by a hydraulic pipeline. Reserves of phosphate rock in the TAIBA deposit have been estimated at from 26 to 40 million tons.

[78] Prepared by Henry E. Stipp.

[79] Where necessary, values have been converted from CFA francs to U.S. dollars at the rate of CFA francs 248 equals US$1.

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Table 39.—Senegal: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Titanium:					
Ilmenite concentrate, gross weight	1,320	---	---	---	---
Rutile concentrate, gross weight	54	---	---	---	---
Zirconium concentrate, gross weight	554	---	---	---	---
NONMETALS					
Attapulgite	---	1,775	2,616	1,500	e 1,500
Cement, hydraulic thousand tons	205	181	194	175	202
Fertilizer materials:					
Crude (natural):					
Aluminum phosphate	120,939	134,940	144,781	151,282	120,000
Calcium phosphate	677,081	867,239	990,000	1,115,000	1,100,000
Manufactured:					
Aluminum phosphate, dehydrated	32,254	18,090	51,908	51,762	e 45,000
Other [1]	10,018	7,694	18,904	9,631	10,409
Salt, all types [2] thousand tons	56	51	61	60	84
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline, motor thousand 42-gallon barrels	624	787	592	1,226	785
Kerosine and jet fuel do	206	457	484	133	607
Distillate fuel oil do	514	864	727	822	945
Residual fuel oil do	704	1,051	1,781	1,359	1,506
Liquefied petroleum gas do	[3] 201	27	31	57	70
Total do	2,249	3,186	3,615	3,597	3,913

e Estimate.
[1] Includes products marketed under trade names of Baylifos and Phosphal.
[2] Includes production of Mauritania, estimated at 500 to 800 tons a year.
[3] Includes 181,000 barrels of partly refined products.

Senegal's balance of trade for mineral commodities and total trade improved in 1967 as shown in the following tabulation:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1965	11.2	128.4
1966	15.8	148.9
1967	16.1	137.7
Imports:		
1965	19.2	164.3
1966	16.8	161.0
1967	14.9	136.4

[1] Values given are for those commodities listed in tables 40 and 41 of this chapter.

The principal mineral exports consisted of phosphate rock both crude and manufactured. Value of phosphate rock exports in 1967 increased to $14.8 million compared with $14 million in 1966. Mineral imports in 1967 were mainly petroleum products valued at $6.4 million and iron and steel semimanufactured products valued at $5.5 million. In 1966 petroleum products were valued at $7.3 million and iron and steel semimanufactures $3.6 million.

BRGM continued its survey of the Falémé district for deposits of copper, zinc, molybdenum, tungsten, and nickel. Indications of these minerals have been found near the Bambadji massive. The Kouroudiako district reportedly was the best area for finding significant copper deposits.

Chromite mineralization recently discovered in the Bakel-Kidiri region was surveyed more thoroughly. Six of the 30 recorded anomalies were investigated extensively; however, none of the prospects were considered to be of economic value. Indications appear to be favorable for finding other economic deposits. Traces of copper also were found, but the copper content of the disseminated chalcopyrite was considered to be too low to be of value. Two gold placer deposits were discovered near the Diale and Makabingue Rivers in the eastern region. Several small alluvial diamonds were found in the Falémé region, which was being surveyed more intensively.[80]

[80] Mining Journal (London). V. 270, No. 6932, June 28, 1968, p. 525.

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Table 40.—Senegal: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
METALS		
Copper, metal, including alloys:		
Scrap	668	405
Unwrought	1,722	107
Iron and steel metal:		
Scrap	6,707	3,607
Primary forms and semimanufactures	126	NA
Lead, metal, including alloys, all forms	110	NA
Zinc, metal, including alloys, all forms	15	NA
Other:		
Ore and concentrate	461	------
Metal	17	742
NONMETALS		
Cement and lime	3,875	NA
Clays and clay products,		
Fuller's earth	1,564	e 1,500
Fertilizer materials:		
Crude:		
Aluminum phosphate	r 95,646	93,120
Calcium phosphate	r 715,431	808,085
Manufactured, phosphatic [2]	r 21,811	45,000
Salt and brines	7,965	18,418
Other nonmetals, n.e.s	7,971	20
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	12,370	322

e Estimate. r Revised. NA Not available.
[1] Principal destinations in 1967: Aluminum phosphate; all to France. Calcium phosphate; United Kingdom 232,475; Japan 192,485; West Germany 167,060. Manufactured, phosphatic; France 36,455; Other African countries 8,161; Canary Islands 384.
[2] Includes dehydrated aluminum phosphate and products marketed under trade names of Baylifos and Phosphal.

Table 41.—Senegal: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys: Unwrought and semimanufactures	249	164
Copper; metal, including alloys: Unwrought and semimanufactures	103	220
Iron and steel:		
Scrap	71	NA
Pig iron, ferroalloys, and similar materials	3	NA
Semimanufactures:		
Bars, rods, shapes	11,034	11,489
Plate and sheet	5,379	8,096
Tubes, pipes, fittings	2,920	4,540
Others	1,647	110
Lead, metal, including alloys, all forms	66	68
Tin, metal, including alloys, all forms—long tons	16	NA
Zinc, metal, including alloys, all forms	29	NA
Other, metals, nonferrous, n.e.s	2	NA
NONMETALS		
Abrasives, natural, n.e.s	44	NA
Asbestos, crude	NA	183
Cement and lime	2,760	2,277
Clays and clay products	2,115	2,268
Fertilizer materials, crude and manufactured	30,188	46,888
Pyrite (gross weight)	6	NA
Stone, sand and gravel	4,281	NA
Other, nonmetals, n.e.s	1,923	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal and coke, including briquets	278	NA
Petroleum:		
Crude and partly refined	r 152,618	(1)
Gasoline	2,658	1,963
Kerosine	11,124	8,039
Distillate fuel oil	r 49,713	88,773
Residual fuel oil	288,870	342,866
Bitumen and other residues	NA	NA

r Revised. NA Not available.
[1] Less than ½ unit.

Subsidiaries of Texas Gulf Sulphur Co. and Compagnie Francaise des Petroles (CFP) signed agreements to explore for sulfur and oil and gas on permits held by Compagnie des Petroles Total Afrique de l'Ouest (COPETAO) a subsidiary of CFP.[81] The permits cover about 2.5 million acres, mainly offshore from Casamance province. Reportedly 10 large salt dome structures are in the permit areas. The agreements were signed subject to the approval of the Government.

Exploration for crude oil and gas was being conducted by Esso Exploration Senegal and by COPETAO. In early 1968 COPETAO was granted a prospecting license on an offshore area of 1,081 square miles.[82] The company has been exploring an adjoining 3,860-square-mile area since 1962. Esso Exploration Senegal drilled one well off Cap Vert in its offshore concession, which covers an area extending from the northern border of Senegal south to the 14th parallel and seaward to about the 644-foot isobath.

[81] Skillings' Mining Review. Joint Exploration in Africa Planned. V. 58, Mar. 29, 1969, p. 16.
[82] Petroleum Review. V. 22, No. 254, February 1968, p. 59.

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SOMALI REPUBLIC [83]

Although data were not available, mineral production in 1968 probably continued to be insignificant. Trade information for 1967 was incomplete. Mineral exports were very small. Mineral imports were valued at $4.4 million,[84] as compared with total imports of $40.1 million; imports of petroleum products were valued at $2.1 million.[85]

Table 42.—Somali Republic: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967 [1]
EXPORTS		
METALS		
Copper, metal, including alloys, scrap	79	62
Iron and steel, metal, scrap	63	NA
Lead	20	NA
Nonferrous metal scrap	137	191
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	r [2] 41	NA
Copper, metal, alloys, wrought	21	NA
Iron and steel:		
Steel, ingots and primary forms	NA	1,949
Semimanufactures	1,926	3,481
Lead, metal, including alloys, all forms	r [2] 1	NA
Silver, platinum and platinum group metals—troy ounces	353,658	NA
Tin, metal including alloys, all forms—long tons	r [2] 5	NA
Nonferrous metals, n.e.s	r [2] 49	NA
NONMETALS		
Cement, lime, and other building materials	r [2] 29,452	NA
Clays and clay products (including all refractory brick)	r [2] 558	NA
Fertilizer materials:		
Crude	r [2] 82	NA
Manufactured	r [2] 3,934	NA
Salt	r [2] 116	NA
Stone, sand and gravel	16	NA
Sulfur and unroasted pyrite	10	NA
Nonmetallic mineral manufactures	668	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	r [2] 47,151	e 47,000

e Estimate. r Revised. NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 118–122.
[2] Somali Republic. Foreign Trade Returns. 1966.

Among the more important mineral resources reported [86] in Somalia are feldspar deposits totaling 7,000 to 10,000 tons in the Umbeli Mountains; sepiolite deposits that reportedly rank among the world's largest; cassiterite deposits at Dalan; monazite, rutile, and zircon in beach sands west of Berbera; beryl, mica, and columbite in the Umbeli Mountains; gypsum deposits totaling 16 million tons about 14 kilometers from Berbera; and uranium in the Bur Region. Of all these, uranium was of the most interest during the year.

An 1,800-square-kilometer concession for uranium and associated minerals was granted to Western Nuclear Inc. in the Bur Region. Exploratory drilling in the area by a United Nations investigating team revealed the presence of about 2.5 pounds of uranium per ton and of rare-earth minerals, gold, nickel, and platinum.

Italy's Società Minerali Radioattivi Energia Nucleare (SOMIREN) received uranium exploration permits to 8,256 square kilometers in the Bur Region and 45,000 square kilometers in northern Somalia.

The first phase of the United Nations Development Program, which cost $874,000, ended early in 1968 and phase 2, which will cost about $1.8 million, was started. The investigating teams will intensify exploration to determine if the area near Alio Ghelle, about 240 kilometers northwest of Magadisco, contains economic deposits of uranium, thorium, and rare-earth minerals.

Petroleum exploration continued, but no oil was found. Exploratory wells were drilled by Sinclair Somal and Hammar Petroleum Corp. During the year the French Entreprise de Recherches et d'Activitiés Pétrolières (ERAP) acquired a 60-percent interest in the concession held by Scebel Oil Co. and Sheikh Sabah al Ahmad al Jaber al Sabah of Kuwait, whose respective shares are now 10 percent and 30 perecnt.

A West German aid mission was studying the possibility of reopening the marine salt works at Hafun, about 160 kilometers south of Cape Guardafui. Before the salt works were shut down early during World War II, salt production had been as much as 300,000 tons per year.

[83] Prepared by Eugene R. Slatick.
[84] Where necessary, values have been converted at the rate of 1 Somali shilling equals US$0.14.
[85] Somali Statistics. Somali Republic Ministry of Planning and Coordination. June 1969, p. 13.
[86] Somalia. Europa Publications, Ltd. The Middle East and Africa, 1968–69. London, 1968, p. 590.

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SOUTHERN RHODESIA [87]

Reportedly the mineral industry of Southern Rhodesia increased total output of mineral commodities; the value of these products rising to $94.4 million [88] in 1968 compared with about $93.5 million in 1967. The value of these commodities represented 8.6 percent of the 1968 gross domestic product of 1,092 million. The high level of activity in the mineral industry was characterized by a large number of applications to the Government for exclusive prospecting rights, principally for nickel and copper. The areas requested ranged from Penholonga and Inyanga in the eastern districts to western Matabeleland near the Botswana border and from the Lomangundi area to the Lowveld area in the southeast. It was reported that a total of 44 exclusive prospecting orders were granted by the Government in 1968.[89] In September the Government granted five exclusive prospecting orders to the following firms: Johannesburg Consolidated Investment Co. (JCI), three permits; and Prospecting Ventures (Ltd.) a subsidiary of Anglo-American Corporation of South Africa Ltd., two permits. The JCI grants covered 130 square miles between Chiredzi and Chipinga, 131 square miles in the Gwelo area, and 75 square miles near Shangani. Minerals prospected for will include copper, lead, zinc, tungsten, nickel, cobalt, and precious metals. Prospecting Ventures (Ltd.) was granted permission to search for copper and nickel over a 24-square-mile area near Filabusi and over an 11-square-mile area near Shangani.

The Government Minister of Mines stated that the mineral industry would receive added support within the next 2 years by production from 10 new mines which were being developed. Another 17 mines, now in the planning stage, would be developed at a later time. The Government set up a separate Ministry of Mines in 1968 and formed the Mining Promotion Corp. (Pty.) Ltd. to stimulate and coordinate mining development.

Statistical information on production and trade were not available in 1968. These data have not been released by the Government since the imposition of selective sanction against Southern Rhodesia in early 1966 by the United Kingdom and early 1967 by the United Nations. In the trade sector, total exports in 1968 reportedly were valued at $244.7 million compared with $247.5 million in 1967. Reexports in 1968 were valued at $11.8 million. Total imports were valued at $289.9 million in 1968 compared with $261.9 million in 1967. After adjustments Southern Rhodesia had an adverse trade balance of $21.6 million in contrast with a surplus of $23.8 million in 1967. There was little information on the role of minerals in Southern Rhodesia trade; however, it was estimated that mineral exports in 1967 would be valued at from $70 million to $84 million. Apparently the sale of minerals in world markets has replaced the sale of tobacco as Southern Rhodesia's principal source of foreign exchange. Reportedly it was more difficult to trace the origin of some minerals such as copper, nickel, chromite, and asbestos than it was to establish the origin of tobacco grown in Southern Rhodesia. It was apparent that despite economic sanctions a significant quantity of Southern Rhodesia minerals were being sold abroad.

The U.S. Government acting in cooperation with the United Nations issued additional restrictions on trade in commodities or products (including mineral commodities) originating in Southern Rhodesia and exported therefrom after May 29, 1968.[90] Executive Order No. 11419 and its preceding Order No. 11322 of January 5, 1967, covered a wide range of prohibitions, which virtually eliminated all trade between the United States and Southern Rhodesia. Critics of U.S. policy pointed out that chromium ore was being purchased from Southern Rhodesia by other countries to replace chromium ore sold to the United States by those countries, at a 50-percent increase in price. Also U.S. firms who mined and paid for chromium ore prior to the trade restrictions could not remove the ore from Southern Rhodesia. Industry representatives maintained that national security was being jeopardized by this ban against minerals trade.[91]

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[87] Prepared by Henry E. Stipp.

[88] Where necessary, values have been converted from Rhodesian pounds (R£) to U.S. dollars at the rate of R£1 equals US$2.80.

[89] Mining Journal (London). Rhodesia-Mining After UDI. V. 272, No. 6980, May 30, 1969, p. 464.

[90] Federal Register. Presidential Documents. V. 33, No. 148, July 31, 1968, pp. 10837–10838.

[91] Metals Week. V. 39, No. 34, Aug. 19, 1968, p. 6.

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Southern Rhodesia's first aluminum plant was being constructed near Salisbury.[92] Scheduled to begin producing in yearend 1969, at a rate of 1,542 tons per year of semimanufactured products, the plant will cost $728,000 and save about $1,400,000 a year in foreign exchange. The plant was owned by Aluminum Industries Ltd., a consortium composed of Alcan Aluminum of South Africa Ltd., Meficrho Ltd., and Industrial Assets Corp. (Pvt.) Ltd.

Investigation of the potential of a copper deposit, located near the Gwaai River, Wankie district, was scheduled to be intensified.[93] Reportedly copper deposits were found in half of the 22 boreholes drilled in the deposit. Messina (Rhodesia) Development Co. Ltd. the original prospector stated that initial work was sufficiently encouraging to make a viability study. An official announcement of two big copper deposits being located one in the Deadlands area and one 90 miles from Bulawayo, indicated that five big international organizations had entered the mining field to develop and exploit the new deposits. The Anglovaal Co. reportedly was intensifying its prospecting for copper deposits in the Witvlei area of the Territory of South-West Africa near the border with Botswana. The possibility of a major discovery of copper and nickel near the Botswana border aroused considerable interest in mining and Government groups in Salisbury. Roan Selection Trust (Ltd.), which early in the year announced the withdrawal of its operations from Southern Rhodesia, was reported to be interested in prospecting an area of more than 1,000 square miles in Southern Rhodesia. The possibility that the copper and nickel deposit north of Francistown, Botswana, extended across the border into Southern Rhodesia apparently influenced their decision.

Although gold production was valued at about $19 million the number of producing mines had decreased to less than 300 in 1968 compared with 1,574 in 1935.[94] The Shamva mine, a former large producer, was scheduled to be reopened later at a cost of $840,000. General Mining and Finance Corp. (Pvt.) and the Mining Promotion Corp. (Pvt.) were scheduled to prospect for gold, lead, and silver in the Penholonga Valley.[95]

Nickel and other minerals were being investigated in the Inyati area north of Bulawayo by several of the leading mining organizations.[96] Rhodesian Nickel Corp., a subsidiary of Anglo American Corp. of South Africa, was scheduled to spend $28 million to develop the Trojan nickel mine near Bindura and the Madziwa mine near Shamva. The company also was building a 15-million-ton-per-year smelter at Bindura.[97] The Trojan mine started producing at yearend and two shafts were being excavated at the Madziwa mine. It was estimated that by yearend 1969 the two mines would produce 1.2 million tons per year of ore containing 7,500 tons of nickel metal. Copper and cobalt will be produced as byproducts. Reserves at the mines were estimated to be sufficient to last 15 years. The first stage of development at the Empress Nickel Mine, located 40 miles west of Gatooma, was completed. Experimental and pilot plant work was carried out and a small quantity of metal was produced. The mine, owned by Rio Tinto (Rhodesia) Ltd., had estimated reserves of 15 million tons of ore containing 0.81 percent nickel and 0.62 percent copper. Scheduled for full production in 1972 the mine will produce 720,000 tons of ore per year. Employment at the mine totaled 200 Europeans and 2,000 Africans.[98] The Perseverance mine owned by Roan Selection Trust Ltd. had indicated reserves of 3 million tons of ore averaging 5 percent nickel at a depth of 500 feet.[99]

The Dodge mine, located in the Shamva District, had proved reserves of more than 1 million tons of barite. Dodge Mineral Development Co. (Pvt.) owns the mine.

A magnesite deposit 25 miles east of Beit Bridge was mined on an expanded scale in 1968.[1] Construction of a second sorting and screening plant to increase output was completed. The mine and plant is operated by Pande Magnesite (Pvt.) Ltd. a subsidiary of Vereeniging Refrac-

[92] U.S. Consulate, Salisbury. State Dept. Airgram A-119, June 6, 1969, p. 1.
[93] U.S. Consulate, Salisbury. State Dept. Airgram A-158, Mar. 1, 1968, p. 2.
[94] Work cited in footnote 89.
[95] Mining Journal (London). V. 270, No. 6927, May 24, 1968, p. 423.
[96] Standard Bank Review (London). September 1968, p. 15.
[97] Metals Week. V. 40, No. 10, Mar. 10, 1969, p. 13.
[98] U.S. Consulate, Salisbury. State Dept. Airgram A-99, May 23, 1969, p. 1.
[99] Journal of Mines, Metals and Fuels (Calcutta). V. 16, No. 3, March 1968, p. 95.
[1] Industrial Minerals (London). No. 8, May 1968, p. 26.

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tories Ltd. and Cullinan Refractories Ltd. of South Africa.

Construction of the nitrogenous fertilizer factory near Que Que, owned by Sable Chemical Industries, Ltd., was scheduled to begin in early 1968. The $45 million plant was expected to be financed partly by private enterprise. Reportedly the factory's products would be given tariff protection; however, after full production had been reached, local farmers would be provided with ammonium nitrate at about $168 per ton of nitrogen content. The withdrawal of many workers from the United States, owing to tighter enforcement of sanctions on Southern Rhodesia, has hindered construction on the plant.[2] However, the contractor indicated that the first stage of the plant would be completed by April 1969.

The Wankie Colliery Co. Ltd. had sales of 2,969,231 tons of coal in 1968 compared with 2,840,698 tons in 1967. Sales of coke by Wankie totaled 200,743 tons in 1968 as contrasted with sales of 169,282 tons in 1967. Sales figures are the only statistics available on coal and coke. They can be considered to represent about 95 percent of annual production.

SPANISH SAHARA [3]

During the year Empresa Nacional Minera del Sahara (ENMINSA), the Spanish State-owned mining company, decided to mine the phosphate deposit at Bou-Craa, about 100 kilometers southeast of El Aaiun. The deposit contains 1.7 billion tons of high-grade ore. ENMINSA had been unsuccessful in its attempts to get various large foreign companies interested in developing the deposit. Late in the year, however, a French consortium expressed interest in participating in the project. The consortium consists of Pechiney-Saint Gobain, Société Nationale des Pétroles d'Aquitaine, Ugine-Kuhlmann, Pierrefitte, Compagnie Française des Petroles, Compagnie Financiers pour l'Outremer, and Bureau de Recherche s Géologiques et Minières. The total investment in the project is expected to exceed $100 million.

A 3.5-kilometer-long breakwater and an ore-loading pier, together costing about $22 million, were being constructed at El Aaiun, from where the phosphate rock will be sent to Spain and other Western European countries. A contract to build a 100-kilometer-long conveyor system from the deposit to the port was granted to Friedrich Krupp GmbH. The system, costing about $33 million, will have an average span length of 10 kilometers and a capacity of 2,000 tons per hour.[4] It is expected to be completed in mid-1971, when ENMINSA plans to begin production at an initial rate of 3 million tons per year. Production is scheduled to eventually reach 10 million tons per year. A 1,000-ton-per-hour ore crushing plant costing about $9 million is to be built at the mine; several companies placed bids to build the plant, but no contracts were reported.

In exchange for Morocco's agreement not to interfere with the development of the phosphate deposits, which are in contested territory, Spain ceded its African enclave of Ifni to Morocco in early 1969.[5] The Government of Morocco agreed to discuss the issue in a cooperative spirit; it did not drop its territorial claim to the area. Mauritania also has viewed the area as possibly being part of its territory.

During the year the Spanish Government granted a petroleum concession totaling about 19,000 square kilometers to a joint venture comprised of Empresa Nacional Petróleos de Aragon, S.A. (ENPASA), Entreprise de Recherches et d'Activités Pétrolières (ERAP) and Société National des Pétroles d'Aquitaine (SNPA). In November Continental Oil Company acquired a 50-percent interest in part of the concession area held jointly by Compania Española de Petróleos, S.A., and Spanish Gulf Oil Company. The Government offered permits to seven onshore concessions totaling 17,500 square kilometers, but there were no bidders. The areas had been under concession several years ago.

[2] Nitrogen (London). No. 57, January–February 1969, p. 16.
[3] Prepared by Eugene R. Slatick.
[4] Phosphorus and Potassium. Phosphate Transportation by Conveyor in the Spanish Sahara. No. 40, March/April 1969, pp. 25–27.
[5] Engineering and Mining Journal. V. 170, No. 2, February 1969, p. 126.

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SUDAN [6]

Minerals continued to hold a minor place in Sudan's economy in 1968, but interest in mineral exploration continued. Except for the apparent cessation of iron ore production, there was little change in the mineral industry. Production of petroleum products declined slightly because an explosion at the Port Sudan refinery put the plant out of operation for about 2 months.

Mineral exports in 1967 were chiefly nonferrous base metal ores and concentrates, including manganese, which were valued at $511,000,[7] and iron and steel scrap, which was valued at $349,000. The chief mineral imports were crude oil, estimated $10.6 million; iron and steel semimanufactures, $7.9 million; petroleum products, $7.6 million; and fertilizers, $6 million. The values of mineral trade and total trade for recent years were as follows:

During the year the Government amended the Petroleum Resources Development Act of 1958 so that royalty payments will be considered as an income tax, thereby exempting prospective developers from double taxation, and so that oil leases would not be liable for other Sudanese taxes on profits or income. The Government also began drafting a law that will define the national jurisdiction of mineral deposits in the Red Sea.

Kamal Abdel Moneim International Co., a Sudanese firm, was granted an exploration concession in the Ingessania Hills of Blue Nile Province. The company reported finding a chromite deposit between Kukur and Soda, and was planning to mine it. A road will have to be built to the railroad at Er Roseires, about 80 kilometers away. The chromite mine of Mining and Trading Co. Ltd. of Sudan is in the same area.

The Iron ore deposits at Fodikwan, Grab Delhit, and Naukuri were being considered for a joint development undertaking by the Sudanese-Yugoslav company, Fodikwan Mining Company, and Japan's Ataka Sangyo Company. If development plans are realized, most of the production would be exported to Japan. The total reserves of the deposits, all in the northern part of the country, are estimated at 200 million tons with an iron content of more than 40 percent.

Late in the year a consortium comprised of Amad N.L., Gulf International (Sudan), and Kenneth McMahon and Partners was formed to prospect in a 2.5-million-square-kilometer area.[8]

There were no reports of any discoveries from the mineral survey project that the United Nations Development Program Fund approved in 1967. The main mineral deposits that were to be evaluated were copper, at Hofrat en Nahas, Darfur Province, where deposits containing 2.78 percent copper total an estimated 10 million tons; nickel and gold in Kassala Province; chromite in Blue Nile Province; and mica in Northern Province.

[6] Prepared by Eugene R. Slatick.
[7] Where necessary, values have been converted at the rate of 1 Sudanese pound (S£) equals US$2.87.
[8] Mining Journal (London). V. 272, No. 6961, Jan. 17, 1969, p. 59.

Table 43.—Sudan: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965 [1]	1966 [1]	1967	1968
METALS					
Chromium, chromite, gross weight thousand tons	17	30	17	r 25	22
Gold, mine output, metal content troy ounces	877	300	200	200	29
Iron ore and concentrates thousand tons	(2)	35	39	r 14	--------
Manganese, ore and concentrate, gross weight	• 8,500	1,000	1,500	r 2,500	5,000
Silver, mine output, metal content troy ounces	40	--------	--------	--------	--------
NONMETALS					
Cement, hydraulic thousand tons	91	80	100	r 133	145
Gypsum and anhydrite, crude	4,520	4,290	1,921	r 3,732	10,226
Magnesite, crude	--------	--------	3,000	r 4,000	6,500
Salt, all types	60	52	43	r 57	50
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products thousand 42-gallon barrels	--------	2,155	4,174	r • 4,300	4,063

• Estimated. r Revised.
[1] All data estimated
[2] Less than ½ unit.

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Table 44.—Sudan: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Iron and steel:		
Ores	47,694	8,750
Metal, scrap	9,113	7,857
Manganese, ore and concentrates	1,150	(1)
Other nonferrous base metals: Ore and concentrate	11,000	20,500
Nonferrous metal scrap	999	1,000
NONMETALS		
Natron	7	62
Salt	1,711	216
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products thousand 42-gallon barrels	275	29
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	1,212	1,390
Copper, metal, including alloys, all forms	60	155
Iron and steel:		
Ingots and other primary forms	170	40
Semimanufactures	90,477	77,284
Lead, metal, including alloys, all forms	146	69
Tin, metal, including alloys, all forms—long tons	60	61
Zinc, metal, including alloys, all forms	55	9
Metallic oxides, mainly for paints	157	222
NONMETALS		
Abrasives:		
Natural	52	3
Grinding stones and wheels	302	78
IMPORTS—Continued		
NONMETALS—Continued		
Cement—thousand tons	48	17
Chalk	340	144
Clay and clay products (including refractory bricks)	704	423
Fertilizer materials:		
Manufactured:		
Nitrogenous	74,086	66,065
Phosphatic	164	330
Mixed (other)	9	10
Sulfuric acid and other inorganic acids	228	480
Gypsum	683	4
Lime	1,211	410
Mica, crude	3	------
Salt	61	47
Sodium and potassium compounds, n.e.s.:		
Caustic soda	3,844	3,170
Caustic potash	21	1
Stone, sand and gravel:		
Dimension stone	4	6
Sand gravel and crushed rock	49	NA
Nonmetallic minerals, crude, n.e.s.	46	48
Chemical elements and bases, inorganic, n.e.s	27	37
Nonmetallic mineral manufactures n.e.s	835	177
MINERAL FUELS AND RELATED MATERIALS		
Asphalt, natural	------	1
Coke and semicoke	300	------
Petroleum:		
Crude thousand 42-gallon barrels	e 4,450	e 5,900
Refinery products—do	469	1,626
Mineral tar and crude chemicals from coal, oil, and gas distillation	------	275

e Estimated. NA Not available.
[1] Included in other nonferrous base metals.

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	2.5	195.0
1966	r 1.8	203.0
1967	1.1	212.8
Imports:		
1965	e 31.5	207.5
1966	30.0	222.3
1967	e 35.7	233.0

e Estimate. r Revised.

SWAZILAND [9]

The mineral industry of Swaziland, a small country in southern Africa which received its independence from Great Britain in September 1968, made a significant contribution to the nation's economy. Production of mineral commodities was valued at $25.7 million [10] or 32 percent of

[9] Prepared by Henry E. Stipp.
[10] Where necessary, monetary values have been converted from South African Rand (R) to U.S. dollars at the rate of 1R equals US$1.

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the gross domestic product estimated at $80 million in 1968. In addition about 7,000 laborers worked in the mines in the Republic of South Africa and repatriated about $137,000, which helped to conserve foreign exchange. In 1968 an average of 2,400 persons were engaged in mining out of a total labor force estimated at 45,000 employed within Swaziland. The United Nations Development Program continued its survey of potential mineral deposits and also worked on problems of mineral beneficiation. The airborne geophysical survey conducted since 1967 was concluded. The next phase of mineral prospecting by geochemical and conventional methods was started. The Institute of Geological Sciences, London, also participated in the program from May to early June. Geological maps of Swaziland, on a scale of 1:50,000 were prepared and printed in color by the Directorate of Overseas Surveys.

Production of mineral commodities in 1968 was valued at $25.6 million, a record high, compared with $24.5 million in 1967. Principal minerals produced in 1968 were iron ore valued at $16.6 million and asbestos valued at $8.5 million. In 1967 these minerals were valued at $15.8 million and $8.2 million, respectively.

Trade in mineral commodities in 1967 consisted of exports mainly of iron ore valued at $16.6 million and asbestos valued at $8.2 million. In 1966 iron ore exports were valued at $10.6 million and asbestos exports at $7.0 million. Imports of mineral commodities in 1967 were principally petroleum refinery products valued at $4.7 million and fertilizers valued at $1.9 million. In 1966 the imports listed above were valued at $3.0 million and $1.4 million, respectively. The relationship of trade in mineral commodities compared to total commodity trade was as follows:

	Value (million dollars)	
	Mineral commodity trade [1]	Total commodity trade
Exports:		
1965	14.4	43.0
1966	18.0	58.7
1967	25.0	58.8
Imports:		
1965	7.2	36.6
1966	r 8.4	r 35.8
1967	11.2	46.5

r Revised.
[1] Values given are for only those commodities listed in table 46 of this chapter.

Iron ore reserves at the Ngwenya mine of Swaziland Iron Ore Development Co. reportedly have been proved at 43 million tons to a depth of 600 feet.[11] The main section contains about 19 million tons of ore averaging 62 percent iron content. Apparently the remaining 24 million tons contain ore of a lower iron content. Swazi-

[11] Mining Journal (London). V. 271, No. 6943, Sept. 13, 1968, p. 185.

Table 45.—Swaziland: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity [1]	1964	1965	1966	1967	1968
METALS					
Gold, mine output, metal content—troy ounces	2,078	1,619	308	--------	--------
Iron ore, direct shipping—thousand tons	60	1,020	1,591	1,744	2,050
Tin, concentrates—long tons	3	2	1	--------	--------
Silver, mine output, metal content—troy ounces	130	130	28	--------	--------
NONMETALS					
Asbestos, chrysotile	36,162	37,089	32,787	36,427	38,960
Barite	15	491	1,043	565	888
Clays:					
Diaspore	374	--------	--------	--------	--------
Kaolin	312	753	587	1,860	2,145
Stone:					
Pyrophyllite	1,995	920	435	599	581
Other	--------	--------	--------	28,171	[2] 48,577
MINERAL FUELS AND RELATED MATERIALS					
Coal:					
Anthracite	4	20	67	--------	--------
Bituminous	4,073	r 29,966	66,759	77,962	96,789

r Revised.
[1] In addition to commodities listed, simple construction materials such as clay and sand and gravel were produced, but quantitative data are not available.
[2] Cubic yards.

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Table 46.—Swaziland: Foreign trade in selected mineral commodities

Commodity	1966	1967
EXPORTS [1]		
METALS		
Gold—troy ounces	308	------
Iron ore—thousand metric tons	1,591	1,744
Silver—troy ounces	28	------
Tin concentrates—long tons	1	------
NONMETALS		
Asbestos, chrysotile—metric tons	32,787	36,427
Barite—do	1,043	888
Clay and clay products, kaolin—metric tons	587	2,145
Pyrophyllite—do	435	580
MINERAL FUELS AND RELATED MATERIALS		
Coal—do	1,963	NA
IMPORTS [2]		
METALS		
Steel reinforcements and corrugated iron—value, thousands	r $350	$407
Steel windows, doors and frames—value, thousands	r $171	$220
Plumbing and sanitary fittings—value, thousands	r $189	$150
NONMETALS		
Cement, bricks and asbestos products—value, thousands	r $904	$514
Piping for buildings, irrigations, etc—value, thousands	r $339	$119
Fertilizer—do	r $1,481	$1,900
MINERAL FUELS AND RELATED MATERIALS		
Gasoline—do	$1,277	$1,950
Diesel oil—do	$935	$2,037
Lubricating oil and greases—do	$361	$701
Total	r $6,007	$7,998

r Revised. NA Not available.
[1] Ministry of Commerce Industry and Mines (Mbabane). Annual Report of the Geological Survey and Mines Department. Dec. 31, 1967, p. 41.
[2] Standard Bank Review (London). September 1968, p. 27.

land's Minister of Finance stated that the feasibility of processing iron ore within the nation was being investigated by an engineer from the United Nations.[12] Swaziland has signed contracts with Japanese steel firms for delivery of 18 million metric tons (13 million tons lump ore and 4.6 million tons of fines) by 1974. Installation of an ore beneficiation plant would prolong the life of the Ngwenya mine, which contributes significantly to the economy of the country.

In October, Minerals Holdings Ltd., a subsidiary of London-Rhodesia Mining and Land Co. Ltd. (LONRHO), was granted a prospecting permit over a 24-square-mile area adjoining the Havelock asbestos mine at Emlembe. At the same time a mining lease was also initiated, in case LONRHO decides to develop a mine in the area. Investment was to be from $14 million to $21 million. Earlier in the year a Portuguese company reportedly was studying the feasibility of processing crude asbestos within Swaziland.

A cement grinding and bagging plant was being constructed in the Matsapa area for the Matola Cement Co. Ltd.[13] Raw material for the plant will be imported from the Matola Cement Works near Lourenço Marques. The cost of the project was expected to be about $630,000. Initial production, which will begin in December, will be 30,000 tons per year. This will increase to 100,000 tons per year if a substantial market can be developed. The Swaziland Government will be invited to participate in holding shares of stock in the company. Employment at the plant will total about 50 workers.

Output of coal from Swaziland Collieries Ltd. at Mpaka continued to increase in 1968. Reserves of coal in the Stegi area were estimated at 200 million tons. About half of the coal produced is consumed by the local railway and the remaining quantity is exported to Kenya and Mozambique. A 2,000-milliwatt thermal power station is planned for construction in Swaziland; however, economic feasibility of the power-plant depends upon sales of surplus power to the Republic of South Africa. Consumption of coal would increase sharply, if the proposed thermal electric plant is built.

TOGO [14]

Phosphate rock mining and processing remained Togo's chief mineral industry in 1968; it was also one of the three most important industries in the country. During the year Compagnie Togolaise des Mines du Bénin (CTMB), the phosphate producer, mined about 2.4 million tons of crude phosphate, from which a record

[12] Mining Journal (London). V. 272, No. 6974, Apr. 18, 1969, p. 330.
[13] Barclays Overseas Review (London). October 1968, p. 21.
[14] Prepared by Eugene R. Slatick.

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marketable output of 1,375,000 tons was obtained, compared with 1,123,000 tons in 1967. CTMB increased the capacity of the beneficiation plant at Kpémé to 1.5 million tons per year. According to the company's expansion program, the plant's capacity is to be eventually increased to about 1.8 million tons per year.

In 1967, exports of phosphate rock, Togo's chief mineral export and the only one for which data were available, were valued at $16.6 [15] million, compared with $15.3 million in 1966. Exports of all commodities in 1967 were valued at $32.2 million. Of the 1,005,199 tons of phosphate rock exported, France received 381,719 tons; Netherlands, 204,436 tons; Australia, 132,788 tons; and Japan, 108,224 tons. The chief mineral commodities imported in 1967 were petroleum products (estimated value of $2 million) and iron and steel semimanufactures ($1.9 million). The value of all commodities imported in 1967 was $45.4 million.

The entire coastal sedimentary basin of Togo is to be explored for oil by Frontier Togo Petroleum Co., which received a concession covering about 1,300 square kilometers, mostly offshore and extending to the 12-mile limit. Frontier Togo, which is owned by Frontier Petroleum Co. and Industrial Resources and Capitalization, Inc., both U.S. companies, later farmed out the license to Union Carbide Petroleum Corp. An aerial magnetic survey and marine seismic surveys were completed during the year. The concession terms require drilling to be under way by July 1970.

The 20-million-ton deposit of high-grade dolomite at Gnaoulou, about 145 kilometers north of Lomé, is to be developed by a new company comprised of the Government (two-thirds interest) and Società Italienne de Development Industrial et Commercial (SINCO). A processing plant was under construction at Lomé. Production is scheduled to be about 50,000 tons per year.

The iron ore reserves at Bangéli were estimated at 20 million tons containing 45 to 54 percent iron, and 30 million tons averaging 35 percent iron.[16] Reserves at Bitjabé were estimated at 600 million tons containing 32 to 35 percent iron.

A mineral exploration program was underway during the year. It is being financed by the United Nations Special Fund, the French Fund for Aid and Cooperation, and the Togolese Government. Most of the fieldwork was being done by Institut Geographique National Français (IGN)

Table 47.—Togo: Foreign trade in selected mineral commodities

(Metric tons unless otherwise sepcified)

Commodity	1966	1967 [1]
EXPORTS		
METALS		
Iron and steel:		
Scrap	291	NA
Semimanufactures	44	NA
NONMETALS		
Fertilizer materials, crude phosphate	968,728	1,005,199
Nonmetallic minerals, crude unspecified	118	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	278	NA
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	98	42
Copper, metal, including alloys, all forms	21	NA
Iron and steel:		
Scrap	58	NA
Semimanufactures:		
Bars, rods, and sections	5,332	4,718
Plate and sheet	3,340	2,960
Rails and accessories	349	361
Tubes and fittings	1,624	1,118
Other	355	191
Total	11,000	9,348
Lead, metal, including alloys all forms	18	NA
NONMETALS		
Cement, lime, and other building materials	60,298	29,792
Clays and clay products	336	549
Fertilizer materials, manufactured	181	NA
Stone, sand and gravel	63	65
Nonmetallic minerals, crude unspecified	6,955	NA
Nonmetallic mineral manufactures	61	NA
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke and briquets	60	NA
Petroleum refinery products	61,026	•62,000
Tar, pitch, and other crude chemicals from coal, oil, and gas distillation	138	NA

• Estimate. NA Not available.
[1] Statistical Office of the United Nations. Supplement to the World Trade Annual. V. 3, 1967, pp. 435–440.

[15] Where necessary, values have been converted from CFA francs at the rate of CFA francs 250 equal US$1.
[16] Mining Journal (London). Mining Annual Review. June 1969, p. 327.

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and Bureau de Recherches Géologiques et Minières (BRGM).

In February 1969 an agreement was signed by the governments of Togo, the Ivory Coast, and Lambert, a French financial group, to establish the West African Cement Company to develop a 50-million-ton limestone deposit at Avéta in Togo.

UPPER VOLTA [17]

No minerals have been mined in the Republic of Upper Volta since early 1966, when gold production stopped. Based on available information, the mineral commodity trade in 1967 consisted chiefly of imports of petroleum products, which were valued at $2.3 million;[18] cement, lime, and other building materials, $900,000; and iron and steel semimanufactures, $700,000. Total imports were valued at $35.9 million; total exports at $17.8 million.

Commercial development of the manganese deposit at Tambao had not yet begun. The reserves total 6.9 million tons and contain an average of 52.4 percent manganese; probable additional reserves could raise the total to about 10 million tons. Using strip mining methods, the deposit reportedly could be exploited at a production rate of 480,000 tons per year. The development of the deposit could lead to the establishment of other industries in northeastern Upper Volta.[19] Among these is a cement plant with a capacity of about 100,000 tons per year that would utilize limestone deposits at Tin Hrassan, 29 kilometers west of Tambao. Development costs for the manganese deposit, the cement plant, and a 353-kilometer railroad from Tambao to Ouagadougou are estimated at $48 million.

Hopes that a new gold deposit might be found were stirred by the discovery of several gold nuggets, some weighing as much as 8 troy ounces, in a streambed near Dori, about 75 kilometers southeast of Tambao. The Government was studying the area to determine if there is a major deposit. In the past, gold was mined at Poura, about 175 kilometers southwest of Ouagadougou.

Prospecting by teams of the United Nations Development Program has revealed the presence of extensive copper deposits at Diénéméra, northeast of Gaoua. The deposits apparently are low grade, but they could prove to be exploitable. Indications of antimony, copper, molybdenum, and nickel have been found near Kaya.

Table 48.—Upper Volta: Foreign trade in selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Iron and steel:		
Scrap	298	NA
Semimanufactures	28	NA
Nonferrous ore and concentrate, mainly gold	488	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	54	NA
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	98	NA
Iron and steel:		
Scrap	380	NA
Semimanufactures	4,364	4,644
NONMETALS		
Cement, lime, and other building materials	23,216	• 22,000
Clays and clay products	324	NA
Fertilizer materials, manufactured	559	NA
Nonmetallic minerals, crude	10,557	NA
Nonmetallic minerals, manufactured	66	NA
MINERAL FUELS AND RELATED MATERIALS		
Petroleum refinery products	r 35,203	• 37,000

• Estimate. r Revised. NA Not available.

[17] Prepared by Eugene R. Slatick.

[18] Where necessary, values have been converted at the rate of 1 Communauté Francaise Afrique (CFA) franc equals US$0.004.

[19] Industries et Travaux d'Outre-Mer. Le Gisement de Manganèse de Tambai, clé du Developpement du Nord-Est de la Haute-Volta. No. 178, September 1968, pp. 744–748.

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The Mineral Industry of Other Near East Areas

By David A. Carleton,[1] E. Shekarchi,[2] Eugene R. Slatick,[3] and Walter C. Woodmansee[4]

CONTENTS

	Page		Page
Bahrain	935	Southern Yemen	946
Jordan	937	Syrian Arab Republic	947
Lebanon	939	Trucial States	949
Muscat and Oman	944	Yemen	952
Qatar	944		

BAHRAIN [5]

The announcement that an aluminum plant will be built in Bahrain was the most important mineral development in 1968. The country's petroleum industry continued as the island's most important industrial activity and income from this industry amounted to an estimated $46 million or 85 percent of the total government revenue, including royalty income. More than half this income was received from Abu Safah field production, a Saudi Arabian field. The revenue from this field is shared with Bahrain. Bahrain Petroleum Co. (BAPCO) holds the onshore concession, is the only crude oil producing company, and operates the only refinery. An offshore concession was dropped during the year.

On July 7, 1968, after a 2-day meeting in Abu Dhabi, the heads of State of Bahrain, Qatar, and the seven separate sheikhs of the Trucial States issued a joint communiqué confirming complete agreement in strengthening ties between the nine emirates as a first step toward creating a Federation.

PRODUCTION

Crude oil production rose importantly in 1968 for the fifth consecutive year, averaging 75,404 barrels daily, up 8 percent from 69,507 barrels daily in 1967. Based on estimated realized prices, production was valued at $42 million in 1968 and $39 million in 1967. Gas produced in association with the crude oil also increased; however, total production levels were not reported. Marketed production in 1968 amounted to 4,713 million cubic feet.

Throughput at the BAPCO refinery declined 5 percent in 1968 to 230,997 barrels per day. This decline resulted because in 1967 unusually high runs of Saudi Arabian crude oil were made when stoppages occurred at the Ras Tanura refinery in Saudi Arabia following the Arab-Israeli conflict that year. The most significant change at BAPCO's refinery in recent years has been the decline in gasoline output and a concomitant increase in jet fuel production.

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[1] Supervisory foreign mineral specialist (petroleum), Division of International Activities.

[2] Foreign mineral specialist, Division International Activities.

[3] Foreign mineral specialist (petroleum), Division International Activities.

[4] Physical scientist, Division International Activities.

[5] Prepared by David A. Carleton.

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Table 1.—Bahrain: Production of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968
Crude petroleum	18,000	20,788	22,521	25,370	27,598
Petroleum refinery products:					
Gasoline and naphtha	16,704	14,876	14,505	16,817	12,956
Jet fuel	6,580	8,481	9,456	13,407	15,227
Kerosine	3,469	3,171	2,763	2,304	1,895
Distillate fuel oil	15,764	12,772	12,777	13,963	13,682
Residual fuel oil	27,682	27,534	29,479	37,844	35,574
Other	740	837	265	811	1,345
Total	70,939	67,621	69,245	85,146	80,679
Refinery fuel and loss	8,361	6,737	4,233	4,020	3,866

TRADE

Crude oil and petroleum refinery products are the principal mineral commodities traded in Bahrain. Crude oil imports, all of which were piped from Saudi Arabia, were valued at $85 million in 1968, based on estimated realized prices. Exports of refined products that year were valued at $210 million while bunkers were worth another $10 million. Although petroleum trade in 1968 did not exceed that of 1967, when refinery runs were abnormally high because of stoppages in Saudi Arabia, exports were 16 percent higher than in 1966, a normal year. Bunker loadings in 1968 were 7.1 million barrels, 95 percent of which was residual fuel oil.

Table 2.—Bahrain: Exports and reexports of mineral commodities

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	1966	1967	1968
Metals: Iron and steel, metric tons	• 600	• 900	NA
Nonmetals: Cement, do	• 700	• 1,800	NA
MINERAL FUELS AND RELATED MATERIALS			
Petroleum refinery products:			
Gasoline and naphtha	14,393	16,577	12,538
Jet fuel	9,597	13,152	15,236
Kerosine	2,902	2,353	2,097
Distillate fuel oil	13,146	12,562	13,165
Residual fuel oil	22,819	29,559	28,971
Other	596	667	1,665
Total	63,453	74,870	73,672

• Estimate. NA Not available.

Table 3.—Bahrain: Imports of mineral commodities

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	1966	1967	1968
Metals: Iron and steel, thousand metric tons	• 10	• 12	NA
Nonmetals: Cement, do	• 95	• 80	NA
MINERAL FUELS AND RELATED MATERIALS			
Crude petroleum	49,412	62,445	55,881
Petroleum refinery products:			
Gasoline and naphtha	1,718	1,441	1,057
Kerosine	--------	212	157
Residual fuel oil	--------	103	16
Lubricants	8	10	10
Other	--------	17	[1] 50
Total	1,726	1,783	1,290

• Estimate. NA Not available.
[1] Distillate fuel oil.

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COMMODITY REVIEW

Metals.—*Aluminum.*—On January 6, 1969, the cornerstone was laid for the Persian Gulf's first aluminum smelter. The plant is being built by Aluminium Bahrain, Ltd. (Alba) which is a consortium of the following companies: The Government of Bahrain, 27.5 percent; the British Metal Corp., 25 percent; Aktiebolaget Elektrokoppar (a Swiss company), 25 percent; Western Metals Corp. (a British company), 12.5 percent; and Guinness Mahon (an international banking and investment firm), 10 percent. Ownership may have changed early in 1969 when several semifabricating companies such as General Cable Corp., a U.S. firm, and a company representing a substantial group of British and West German aluminum users were believed to have joined the consortium. Alumina for the plant will be supplied by Alcoa of Australia Pty., Ltd., from Western Australia under a 20-year contract.

British Smelter Constructions will build the plant which eventually will represent an investment of $72 million. The smelter is expected to produce 90,000 metric tons of metal per year and employ 600 persons. Plans are for the plant to begin production in 1970–71 and to reach full production in 1972. The smelter will use the prebaked anode process, which requires a considerable amount of electricity. This will be produced from turbogenerators powered by natural gas from two new wells being drilled by BAPCO. The large quantity of natural gas available at a very low price was one of the main factors in attracting this industry to Bahrain.

Mineral Fuels.—*Petroleum.*—Petroleum development by BAPCO continued during the year with 10 producing wells and two injection wells completed. The second and final phase of improving oil gathering and transportation pipelines was completed. In all, it involved laying 41 miles of flow lines. In addition three new gas/oil separators were being installed at well manifolds at the end of 1968.

The capacity of the hydrogen-desulfurizing unit at the BAPCO refinery was more than doubled during the year to 15,000 barrels daily in response to expanding demand for low-sulfur distillate and residual fuel oils. A polymer unit was converted to increase the recovery of butane previously lost as a gas from the platformer. Other equipment and facilities at the refinery and at loading installations were altered to improve operating techniques.

BAPCO's proved petroleum reserves, estimated at 380 million barrels were only 13 times the production in 1968.

During the year Continental Oil Co. relinquished its 880,000-acre offshore concession and at yearend an unidentified Japanese group was believed interested in the area.

JORDAN [6]

The mineral sector of Jordan's economy in 1968 continued to be dominated by the phosphate, cement and petroleum refining industries. An estimated 6,500 to 7,000 persons were employed in the minerals industry.

In 1968 the Government received about $5 million [7] in transit royalties from the Trans-Arabian Pipeline Co. (Tapline). This was about $1 million more than in 1967, when royalties were lower because the line was shut down during the Middle East crisis. In December 1968 an agreement in principle was reached with Tapline to increase Jordan's royalties because an additional 4 kilometers of pipeline came under the country's jurisdiction as a result of a 1966 border agreement with Saudi Arabia.

In 1967 Jordan's chief mineral export continued to be phosphate which was valued at $9.7 million ($8.8 million in 1966). The principal mineral imports were iron and steel semimanufactures, $11.4 million; crude oil, $6.0 million; lubricants, $1.2 million; and fertilizers, $1.1 million. The values of mineral trade and total trade for recent years were as follows:

	Value (million dollars)	
	Mineral commodity trade	Total commodity trade
Exports:		
1965	7.1	27.8
1966	9.4	29.1
1967	10.0	28.0
Imports:		
1965	20.0	156.9
1966	25.0	191.0
1967	28.0	154.1

[6] Prepared by Eugene R. Slatick.
[7] Where necessary, values have been converted from the Jordanian dinar (JD) at the rate of JD1=US$2.80.

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Table 4.—Jordan: Production of mineral commodities

Commodity [1]		1964	1965	1966	1967	1968
NONMETALS						
Cement	thousand metric tons	308	305	375	321	381
Fertilizer materials: Phosphate rock	do	565	828	1,036	1,237	1,162
Marble	square meters	1,800	• 2,000	• 200	NA	NA
Salt	thousand metric tons	20	20	13	12	16
MINERAL FUELS AND RELATED MATERIALS						
Petroleum refinery products:						
Gasoline, motor	thousand 42-gallon barrels	• 450	460	658	614	609
Kerosine	do	• 511	595	547	534	510
Distillate fuel oil	do	• 813	954	1,014	879	908
Residual fuel oil	do	• 506	600	606	586	598
Liquefied petroleum gas	do	• 406	410	119	114	129
Asphalt	do			247	174	203
Total	do	2,686	3,019	3,191	2,901	2,952

• Estimate. NA Not available.
[1] In addition to commodities listed, Jordan also produces gypsum, limestone, for cement manufacture, and steel reinforcing rods from imported ingot.

Table 5.—Jordan: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
NONMETALS		
Cement	8,695	9,242
Granite and other building stone	8,983	5,227
Lime	332	244
Marble	1,026	1,013
Phosphate (dry)	755,084	881,658
Salt	8,022	NA
Sand:		
Natural	1,145	NA
Bituminous	20,549	NA

NA Not available.

Table 6.—Jordan: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum and alloys, semi-manufactures	612	447
Copper and alloys, all forms	274	273
Iron and steel semimanufactures	93,395	88,025
Lead and alloys, unwrought	784	430
Tin and alloys, semimanufactures long tons	31	17
Metallic oxides	334	178
NONMETALS		
Caustic soda	1,270	1,127
Cement	42,018	36,511
Ceramic construction materials	1,227	813
Fertilizer materials:		
Natural: Phosphate	354	444
Manufactured:		
Nitrogenous	6,949	9,109
Phosphatic	5,107	4,259
Potassic	7,037	1,843
Other	1,132	741
Lime	1,648	1,461
Marble	417	410
Refractory materials, bricks, tiles, etc	438	1,376
Sulfur in all forms:		
Sulfuric acid	1,041	419
Sulfur	2,082	1,793
MINERAL FUELS AND RELATED MATERIALS		
Coal, coke, and briquets	1,002	------
Petroleum:		
Crude thousand 42-gallon barrels	3,438	3,094
Refinery products:		
Gasoline, aviation do	48	37
Kerosine and jet fuel do	153	146
Lubricants do	42	38
Total do	243	221

About 455 million tons of copper-bearing sandstones containing about 8 to 10 percent recoverable copper were discovered in 1968 in the Wadi Araba region of southwestern Jordan. The major deposits are near Kherbet Saloun, Oum Oumad, and Wadi Kcheila.[8] At yearend the economic importance of the find was being evaluated.

During the year, Jordan Phosphate Mines Co. was expanding its facilities. The company has three open-pit mines near El Hasa and one open-pit mine and two underground mines at Ruseifa. At El Hasa, a second beneficiation plant, with an annual capacity of 500,000 tons, and associated drying storage, and handling facilities were under construction. Fifty 30-ton trailer trucks were also ordered. When in operation, the new units will raise the productive capacity at El Hasa to about 1.3 million tons per year. At Ruseifa, additional grinding and beneficiation units were

[8] Engineering and Mining Journal. V. 169, No. 6, June 1968, p. 326.

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being installed to raise output capacity to about 700,000 tons per year.

Phosphate is presently shipped to the port of Aqaba by truck. In conjunction with the expansion plans of Jordan Phosphate Mines Co., the Aqaba Port Authority was considering financing the construction of a railroad spur from Hattiyeh on the Hedjas Railroad, to Aqaba. Engineering studies were completed in 1967.

Two 60,000-ton phosphate storage units were under construction at Aqaba in 1968; they will raise the total phosphate storage capacity there from 40,000 tons to 160,000 tons. A second deep-water berth was being built to accommodate 50,000-deadweight-ton ships; the existing berth can accommodate 15,000-deadweight-ton ships.

Phosphate rock in six different grades, ranging from an unbeneficiated standard grade to a high-grade concentrate, were made available for export in 1968. The United Nations Industrial Development Organization, reporting on a study begun in 1967, advised the Jordanian Government against building a nitrogenous fertilizer plant because the domestic demand for fertilizers is too small to make it economical.[9] Jordan's phosphate industry was reviewed in an article published during the year.[10]

Oil exploration in a 16,000-square-kilometer area in Wadi Sirhan, in eastern Jordan, will be undertaken by the Yugoslav State-owned petroleum enterprise, Industrija Nafte Zagreb (INA). INA and the Jordanian Government's Natural Resources Authority (NRA) signed a 6-year exploration agreement in March. INA's obligations are to drill at least 11,000 meters or spend at least $3.5 million during the first 3½ years; thereafter, it must drill an average of 1,100 meters or spend $250,000 quarterly. If commercial oil is found, NRA will become a partner with INA in a joint company, Jordan Yugoslav Petroleum Company (JOYUPEC). The new company would have an exploitation period of 25 years (renewable for 15 years more). The Government would be entitled to a royalty of 12.5 percent on the oil produced, either in cash or kind, and an income tax equal to 50 percent of the profits of the company.

In November, the Government signed an agreement with the Rumanian Government whereby the latter is to explore for oil and provide oil exploration services and equipment in Jordan. To implement the projects, Rumania will provide loans for a maximum of 8 years and at an annual interest rate of 2.5 percent; 60 percent of the value of the loans will be repaid in crude oil, phosphate, or other minerals, and 40 percent will be repaid in sterling.

Crude oil throughput at the Zerka petroleum refinery in 1968 averaged 8,340 barrels per day, about 11 percent over its rated capacity of 7,500 barrels per day. Crude oil is sent to the refinery through an 8-inch, 30-mile spur pipeline from the Trans-Arabian Pipeline. During the year, Jordan Petroleum Refining Company gave an $8.4 million contract to Chiyoda Chemical Engineering and Construction Co., Ltd., a Japanese company, to increase the rated capacity of the Zerka refinery to about 15,000 barrels per day.

LEBANON [11]

There were no major developments in the mineral industry of Lebanon during 1968. Estimated total value of mineral industry production during the year was $48.7 million,[12] including $27.3 million for petroleum products (ex-refinery) and $17.7 million for cement. The gross national product advanced to an estimated $1.4 billion[13] as the economy continued to adjust to conditions prevailing since the June 1967 war. There was a widening choice of industrial investment opportunities, with the Government objective of attracting investment and attaining greater economic diversification.

Production was normal at two steel mills, which produce mainly reinforcing bars, and at the aluminum mill of Sciale Aluminum Co., which makes bars and finished products and supplies about 80 percent of the domestic aluminum market. In the nonmetals sector, production and domestic sales of cement continued to decline, while

[9] Nitrogen. No. 54, July/August 1968, p. 10.
[10] Phosphorus and Potassium. The Jordanian Phosphate Mining Industry. No. 34, March/April 1968, pp. 14–17.
[11] Prepared by Walter C. Woodmansee.
[12] Where necessary, values have been converted from Lebanese pounds (£L) to U.S. dollars at a rate of 1£=$0.3246.
[13] U.S. Dept. of Commerce, Bureau of International Commerce, Overseas Business Reports, "Basic Data on the Economy of Lebanon" June 1969, p. 2.

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production of lime for construction use increased substantially. The new 140,000-ton-per-year fertilizer plant of Esso Fertilizer Co., S.A.L., was completed at Ras Salata, near Tripoli.[14] Output of petroleum products was increased at Lebanon's two refineries.

Principal mineral commodity exports (excluding transshipped crude petroleum) during 1967, the latest year for which these data are available, were gold, $3.9 million; iron and steel, mainly semimanufactures, $2.7 million; building materials, mainly asbestos cement products, $2.6 million; aluminum, $1.9 million; and nonmetallics, $1.5 million. Total value of mineral exports was $15 million, about 12 percent of export trade in all commodities.

[14] World Petroleum. V. 39, No. 5, May 1968, pp. 56, 58.

Table 7.—Lebanon: Production of mineral commodities

(Thousand metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Iron and steel: Semimanufactures •	45	55	60	55	55
NONMETALS					
Cement	881	970	1,096	1,016	906
Clays, kaolin	NA	NA	NA	3	--------
Dolomite	NA	NA	NA	140	--------
Gypsum •	20	20	27	30	40
Lime •	27	40	65	50	90
Quartz, silica sand •	10	10	10	10	10
Salt •	20	24	25	30	30
MINERAL FUELS AND RELATED MATERIALS					
Petroleum, refinery products:					
Gasoline, thousand 42-gallon barrels	2,034	2,405	2,628	r 2,633	2,912
Kerosine, do	961	1,008	1,194	r 1,440	1,602
Distillate fuel oil, do	1,628	1,774	1,621	r 2,010	2,111
Residual fuel oil, do	4,408	5,136	5,977	r 6,018	6,036
Other, including liquefied petroleum gas, do	140	220	241	r 135	402
Total, do	9,171	10,543	11,661	r 12,236	13,063
Refinery fuel and loss, do	392	443	677	649	333

• Estimate. r Revised. NA Not available.

Table 8.—Lebanon: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, all forms	r 3,634	2,570
Copper, metal, including alloys, all forms	340	485
Gold, metal, unworked or partly worked, troy ounces	r 58,852	108,903
Iron and steel:		
Iron oxide	--------	2
Scrap	4,426	30,514
Pig iron	42	131
Steel, primary forms and semimanufactures	r 16,651	14,535
Lead:		
Oxide	--------	15
Metal, including alloys, all forms	r 50	172
Magnesium, metal, semimanufactures	1	4
Platinum group, metals, including alloys, all forms, troy ounces	1,768	450
Silver, metal, including alloys, all forms, do	--------	62,726
Zinc:		
Oxide	1	1
Metal, including alloys, all forms	13	1
Other:		
Ash and residue containing nonferrous metals	462	398
Precious metals, waste and scrap, troy ounces	--------	25,880
Oxides and hydroxides of metals, n.e.s.	9	--------
NONMETALS		
Abrasives, natural, n.e.s.:		
Pumice, emery, natural corundum, etc	2	28
Grinding and polishing wheels and stones	10	21
Cement	r 18,420	35,513
Chalk	7	44

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Table 8.—Lebanon: Exports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967
NONMETALS—Continued			
Clays and clay products:			
Crude clays		33	42
Products:			
Refractory		184	139
Nonrefractory		1,282	553
Diamond, all grades	carats	18,260	555
Diatomite		51	5
Fertilizer materials:			
Crude		5	27
Manufactured:			
Nitrogenous		479	9,855
Phosphatic		r 14,399	17,483
Potassic		134	10
Other		15	1,071
Ammonia		2,238	1,681
Gem stones, precious and semiprecious, except diamond	carats	82,360	173,245
Graphite		4	9
Gypsum and anhydrite		1,051	693
Lime		27,422	40,016
Pigments, mineral		12	13
Pyrite		2	94
Salt		r 31	11
Sodium and potassium compounds, n.e.s.:			
Caustic soda		16	9
Other		28	30
Stone, sand and gravel:			
Dimension stone, crude and partly worked:			
Calcareous		463	856
Noncalcareous		61	44
Dimension stone, worked:			
Paving and flagstone		78	2
Other		318	1,041
Gravel and crushed rock		r 834	736
Sand		4,816	2,047
Sulfur:			
Elemental, all forms		70	793
Sulfuric acid		2,238	1,681
Talc and steatite		1	3
Nonmetallic minerals, n.e.s.:			
Crude		1	1
Building materials of asphalt, asbestos and fiber cement		29,035	27,433
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		r 21	32
Coal, all grades		959	950
Coke and semicoke		811	994
Petroleum, refinery products:			
Gas oil and fuel oil	42-gallon barrels	2,958	1,058
Lubricants	do	406	903
Liquefied petroleum gas	do	11,588	1,837
Other, mainly mineral jelly and wax	do	r 8	8
Total	do	r 14,955	3,806

r Revised.

Mineral commodity imports (excluding crude petroleum) during 1967 were valued at $171 million and comprised about 36 percent of total imports. Principal mineral commodities imported were gold, $104.4 million; petroleum refinery products, $28.9 million; iron and steel, mainly semimanufactures, $22.2 million; nonferrous metals, mainly aluminum and copper, $4.1 million; and nonmetallics, $4.0 million. Lebanese ports remained important centers for transshipment of Middle East crude oil to the West and petroleum refinery products to the East, particularly to Jordan, Iraq, Syrian Arab Republic, and Saudi Arabia. Reexport trade in mineral commodities totaled $18 million during 1967, including $16.4 million for petroleum products.

The two refineries—Iraq Petroleum Co. (IPC) at Tripoli and Mediterranean Refining Co. (MEDRECO) at Sidon—expanded operations during 1968 after the lull in activities during 1967. Crude oil was delivered to IPC at an average rate of 20,800 barrels per day (18,460 barrels per day in 1967). MEDRECO received

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Table 9.—Lebanon: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity		1966	1967
METALS			
Aluminum:			
Oxide and hydroxide		1,206	751
Metal, including alloys, all forms		r 4,506	4,236
Copper, metal, including alloys, all forms		r 532	630
Gold, metal, unworked or partly worked	thousand troy ounces	3,284	2,940
Iron and steel:			
Iron oxide and hydroxide		94	41
Metal:			
Scrap		700	2,167
Pig iron and ferroalloys		10,441	5,211
Sponge iron, powder, and shot		18	12
Semimanufactures		272,795	222,805
Lead:			
Oxide		132	102
Metal, including alloys, all forms		1,044	1,326
Mercury	76-pound flasks	r 1,084	60
Nickel, metal, including alloys, all forms		r 5	5
Platinum group, metals, including alloys, all forms	troy ounces	r 3,318	4,092
Silver, metal, including alloys, all forms	do	775,154	56,072
Tin, metal, including alloys, all forms	long tons	38	38
Titanium, oxide		631	679
Zinc:			
Oxide		63	42
Metal, including alloys, all forms		r 1,007	504
Other:			
Ores and concentrates, n.e.s.		754	2,007
Ash and residue containing nonferrous metals		90	86
Oxides and hydroxides of metals, n.e.s.		39	86
Metals, including alloys, all forms, n.e.s.		104	48
NONMETALS			
Abrasives, natural, n.e.s.:			
Pumice, emery, natural corundum, etc		9,836	47
Grinding and polishing wheels and stones		216	197
Asbestos		4,517	5,024
Barite		7	32
Cement		22,880	7,418
Chalk		1,740	1,122
Clays and clay products:			
Crude clays		2,595	3,328
Products:			
Refractory		r 4,398	4,466
Nonrefractory		r 12,064	8,006
Cryolite and chiolite		7	------
Diamond, all grades	carats	20,750	67,710
Diatomite		1,207	139
Feldspar and fluorspar		274	385
Fertilizer materials:			
Natural:			
Phosphate rock		38,393	4,012
Other		979	839
Manufactured:			
Nitrogenous		60,286	21,654
Phosphatic		r 1,974	304
Potassic		5,643	7,581
Other		875	656
Ammonia		2,008	1,994
Gem stones, precious and semiprecious, except diamond:			
Natural	thousand carats	7,765	2,346
Manufactured	do	4,632	3,712
Graphite		10	35
Gypsum and anhydrite		23,980	20,548
Lime		11	10
Magnesite		204	9
Mica, all forms		25	6
Pigments, mineral		66	77
Pyrite		2	58
Salt		418	594
Sodium and potassium compounds, n.e.s.:			
Caustic soda		5	37
Caustic potash, sodic and potassic peroxides		3,228	3,048
Stone, sand and gravel:			
Dimension stone:			
Crude and partly worked:			
Calcareous		22,279	19,083
Noncalcareous		6,486	3,720

See footnote at end of table.

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Table 9.—Lebanon: Imports of mineral commodities—Continued

(Metric tons unless otherwise specified)

Commodity		1966	1967
NONMETALS—Continued			
Stone, sand and gravel—Continued			
Worked:			
Paving and flagstone		14	8
Other		257	398
Dolomite		39	10
Gravel and crushed stone		8,748	8,796
Limestone, except dimension		--	30
Quartz and quartzite		3	18
Sand		3,010	4,317
Sulfur:			
Elemental, all forms		r 11,628	13,079
Sulfur dioxide		2	7
Sulfuric acid		149	43
Talc and steatite		170	292
Other nonmetals:			
Crude		11	1
Building materials of asphalt, asbestos and fiber cement, and unfired materials, n.e.s.		401	146
MINERAL FUELS AND RELATED MATERIALS			
Asphalt and bitumen, natural		6	25
Carbon and carbon black		78	87
Coal, all grades		1,750	2,202
Coke and semicoke		3,666	2,280
Peat		2	55
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels	r 2,542	2,539
Kerosine	do.	348	375
Gas oil and fuel oil	do.	3,813	3,879
Lubricants	do.	r 89	96
Liquefied petroleum gas	do.	r 468	577
Bituminous residues and mixtures	do.	166	158
Other, mainly mineral jelly and wax	do.	5	6
Total	do.	r 7,431	7,625
Mineral tar and other coal-, petroleum-, or gas-derived crude chemicals		404	468

r Revised.

crude oil at a lower average rate of 15,835 barrels daily (16,858 barrels per day in 1967), owing mainly to a 15-day labor strike in October. Total throughput at both refineries was 13,396,000 barrels in 1968, compared with 12,885,000 barrels in 1967.

Trans-Arabian Pipeline Co. (TAPline) throughput of crude oil to the Sidon terminal totaled 120,800,000 barrels (331,000 barrels per day) in 1968, largely for transshipment to the West. IPC pipeline throughput to the Tripoli terminal was 143,800,000 barrels (nearly 394,000 barrels per day). At yearend the daily transshipment rate of the two pipelines exceeded 1 million barrels. The Ministry of Economy required TAPline and IPC to maintain emergency reserves of 150,000 tons (1.1 million barrels) and 120,000 tons (0.9 million barrels), respectively.[15]

Domestic sales of refinery products were as follows during 1967 and 1968:

Product	Thousand barrels	
	1967	1968
Gasoline:		
Motor	2,693	2,892
Aviation	79	84
Kerosine and jet fuel	2,022	2,355
Distillate fuel oil	1,806	1,904
Residual fuel oil	2,172	2,296

The kerosine market weakened owing to greater use of liquefied petroleum gas. The gain in sales of residual fuel oil was substantially less than in the previous year, because of reduced demand at the cement plants and at dual (thermal-hydroelectric) power plants.

No final decision was made regarding a third petroleum refinery in Lebanon. Late in the year, Saudi Arabia reportedly offered to assume a 40 percent interest in the project.[16]

[15] Petroleum Times. V. 72, No. 1839, Feb. 2, 1968, p. 212.

[16] Oil and Gas Journal. V. 66, No. 51, Dec. 16, 1968, p. 56.

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MUSCAT AND OMAN [17]

Crude petroleum and associated natural gas are the only known minerals produced in Muscat and Oman. Other than small amounts used in the oilfield area, all natural gas produced is flared. Cement and petroleum refinery products are believed to be the major mineral commodities imported; however, definitive data on the trading of mineral commodities other than crude oil exports are not available.

Output from the two fields of Petroleum Development Oman Ltd. (PDO), the only inland petroleum concessionaire, totaled 87,854,000 barrels in 1968. Average production during the last quarter of the year was 300,000 barrels per day. Production from the only other oilfield (Yibal) in Muscat and Oman was scheduled to begin early in 1969. Oil from Yibal field is the lightest (40° API) and has a sulfur content of less than 1 percent. Blending the latter oil with that from the other fields will improve the salability of PDO crude in foreign markets. Furthermore, the location of the loading terminal Mina al Fahal, on the Gulf of Oman near the entrance to the Persian Gulf, is 780 miles nearer to West European and Japanese markets than is Kuwait or Iraq. Essentially all of the oil produced was exported. Production was valued at $130 million and government revenue from exports was an estimated $70 million.

Preliminary to the relinquishment of one-third of its 82,000-square-mile concession area on January 1, 1970, PDO has been conducting extensive exploration. During 1968 three unsuccessful exploration wells were drilled and 76 party-months of geophysical and geological surveying were performed.

Ownership of the offshore concession held by Wintershall A.G. and other West German companies was redistributed during the year. Shareholding is now Wintershall A.G., 25 percent; Union Carbide Corp., 20 percent; PDO, 20 percent; Compagnie Française des Pétroles, 12.5 percent; Gelsenkirchen Bergwerks A.G., 12.5 percent; and Deutsche Schachtbau-und Tiefbohr GmbH., 10 percent. Wintershall A.G. remains the operator and is now drilling its first exploration well from a floating platform in 300 feet of water off the Batinah coast.

There has been no offshore or onshore petroleum exploration activity in the Dhofar section of the country since 1967.

QATAR [18]

The sheikdom's economy continued to be dominated by the petroleum industry. Estimated value of petroleum production in 1968 was $200 million and government income was about $128 million, including certain retroactive payments, up from about $110 million in 1967. Because the Government is dependent on petroleum revenues for around 90 percent of its income, the country has launched a program of resource diversification, including several mineral-oriented projects. The first, a 100,000-ton-per-year cement plant was virtually completed at yearend 1968. The plant was built by Qatar National Cement Manufacturing Co. (60 percent private domestic capital and 40 percent government) at Umm Bab on the west coast. Production of both ordinary portland cement and sulfate-resistant cement from local raw materials will have an export bias.

The most important project under the diversification scheme is a $44 million fertilizer plant to be built on the east coast near Umm Said. It will be owned by Qatar Fertilizer Co. (QAFCO) which is controlled by the Qatari Government but has several foreign shareholders. The designed capacity is 330,000 tons of urea and 100,000 tons of ammonia annually. Qatar Petroleum Co., Ltd. (QPC) will supply, free of charge, associated natural gas from Dukhan oilfield. The Government will build the pipeline from the field to the plant (about 50 miles), charging QAFCO for delivery. The scheme is scheduled for completion by mid-1972. The major market for output will be developing countries bordering the Indian Ocean. During 1968, the Government requested the assistance of competent organizations in performing a mineral exploration survey of Qatar.

[17] Prepared by David A. Carleton.
[18] Prepared by David A. Carleton.

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PRODUCTION AND TRADE

Crude oil production increased only 5 percent in 1968, the lowest increase rate since 1963. Offshore production continued to make substantial gains; however, onshore production dipped slightly. All of the offshore output was exported and except for the minuscule amounts charged to the Umm Said refinery, all onshore production was exported. In 1967, 62 percent of the exports went to Western Europe. Principal countries of destination were: France, 22 percent; Republic of South Africa, 13 percent; Italy and Thailand, 11 percent each; and the Netherlands, 9 percent.

Imports of mineral commodities were limited to petroleum refinery products, iron and steel semimanufactures, cement, and other construction materials; however, reliable data on quantities and values were not available for recent years. Considering the high level of economic activity and development, it is believed that imports of the above items have risen substantially.

Table 11.—Qatar: Exports of crude petroleum and imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968
Crude petroleum	77,885	84,215	105,945	118,083	124,220
Petroleum refinery products:					
Gasoline	59	64	60	r 59	• 60
Kerosine	r 52	35	36	r 32	• 30
Distillate fuel oil	50	56	50	r 52	• 50
Total	161	155	146	r 143	• 140
Refinery fuel and loss	r • 10	r • 12	r 7	r 16	• 10

• Estimate. r Revised.

Table 11.—Qatar: Exports of crude petroleum and imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1965	1966	1967	1968 p
Exports: Crude petroleum	83,354	105,724	116,829	124,000
Imports: Petroleum refinery products:				
Gasoline	r • 150	r 229	251	270
Kerosine	• 30	r 23	27	30
Distillate fuel oil	r • 50	r 78	78	90
Lubricants	• 6	r • 10	• 12	15
Total	r • 236	335	368	405

• Estimate. p Preliminary. r Revised.

COMMODITY REVIEW

Mineral Fuels.—*Petroleum.*—Production from the onshore Dukhan oilfield, the lone field of the QPC, averaged about 193,000 barrels per day. This was down slightly from 1967 output but was at a general level agreed to between QPC and the Government as the most efficient rate of recovery. The miscible gas injection plant was shut down most of the year because of damage to a compressor. As a result, reservoir pressure in the No. 3 limestone continued to fall. The water injection plant operated satisfactorily. No wells were drilled by QPC during the year and the small 600-barrel-per-day topping plant was sold by QPC to the Government.

Offshore production by Shell Oil Co. of Qatar, Ltd., averaged 146,424 barrels daily, of which 73 percent was from Maydam Mahzam field and 27 percent from Idd-el-Sharji. During the year the company performed 4.3 party-months of seismic surveying, drilled two exploration wells, and finished four development wells. At yearend one development well was being drilled. Several completed wells are await-

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ing the completion of production and transportation facilities.

After drilling about five unsuccessful exploration wells Continental Oil Co. of Qatar Ltd. announced the relinquishment of its 5.7-million-acre onshore-offshore concession in Qatar. Early in 1969 an agreement was signed between the Qatar Government and a Japanese group for exploration of a 2-million-acre offshore area, formerly part of the Continental concession.

Reserves at yearend 1968 were reported [19] to be 3,875 million barrels of crude oil and 7,300 billion cubic feet of natural gas. Although most of the natural gas is flared increasing amounts will be used as new gas-consuming equipment is being installed.

SOUTHERN YEMEN [20]

The first full year of independence for Southern Yemen was difficult. The economy was strained by the continual closure of the Suez Canal and by the concomitant decline in the use of the port of Aden. As a consequence, entrepôt trade, bunkering, and tourism have fallen far below preclosure levels. Furthermore, the new nation has been hurt by the loss of direct income from the now evacuated British community and by the termination of a United Kingdom subsidy which carried through May, 1968. Aid has been promised by the United Nations and a variety of countries in the form of grants or loans. Much of this, however, is for services or assistance in kind; little cash is involved.

The Aden refinery of the British Petroleum Co., Ltd., is the principal source of government revenue; however, the value of output and public income from the plant has also fallen. The gross value of refinery output in 1968 was about £35 million (£2.40 equals U.S. $1.00) compared with about £45 million (£2.80 equaled U.S. $1.00) in 1967.

In October 1968 the government promulgated legislation to regulate mineral exploration and exploitation. Reportedly, international oil companies will be invited to participate in exploration and a geological survey of the entire country is to be undertaken. Rumanians have been examining the feasibility of exploiting mineral deposits believed to have been found in Southern Yemen.

PRODUCTION AND TRADE

Since the country's only refinery was built primarily to meet the bunker demand at Aden, the decline in ocean traffic through Aden has curtailed throughput and output. Throughput in 1968 was about 60 percent of capacity compared with 65 percent in 1967 and 90 percent in 1966.

Major sources for crude oil imports are Kuwait, Iran, and Abu Dhabi of the Trucial States. Based on values, these three countries provided 94 percent of Southern Yemen's imports in 1968. In recent years, because of damage to Egyptian refineries at Suez, the Aden refinery, under contract to the United Arab Republic, has been refining imported crude from fields in the Gulf of Suez and exporting products back to the United Arab Republic. From November 1967 through about June 1968, (the period Suez refineries were shut down), crude oil imports from the United Arab Republic were valued at £2.2 million. Total petroleum imports in 1968 were valued at £27.4 million representing 32 percent of all imports into the country. That year exports of refined products (including bunkers) totaled £36.9 million or 81 percent of all exports.

Bunker loadings, 90 percent of which were residual fuel oil, amounted to 2,886,000 barrels in 1968, down considerably from 10,531,000 barrels in 1967 and 24,809,000 barrels in 1966.

Other than production, no data have been reported on the operations of the Indo-Aden Salt Co. in recent years. Essentially all the production which was valued at £119,000 in 1968 was exported to Japan.

[19] Oil and Gas Journal. V. 66, No. 53, Dec. 30, 1968, p. 102.
[20] Prepared by David A. Carleton.

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Table 12.—Southern Yemen: Production of mineral commodities

Commodity	1964	1965	1966	1967	1968
Nonmetals: Salt—metric tons	81,280	72,481	72,283	e 80,000	78,610
MINERAL FUELS AND RELATED MATERIALS					
Petroleum refinery products:					
Gasoline—thousand 42-gallon barrels	3,393	3,428	4,245	2,840	2,961
Jet fuel and kerosine—do	6,112	5,448	5,856	4,256	4,449
Distillate fuel oil—do	9,479	9,280	9,221	7,370	4,327
Residual fuel oil—do	23,584	24,991	23,832	19,531	17,711
Other, mostly naphtha—do	4,083	4,354	4,377	2,876	4,483
Total—do	46,651	47,501	47,531	36,873	33,881
Refinery fuel and loss—do	3,252	3,714	3,550	3,158	3,794

e Estimate.

Table 13.—Southern Yemen: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	1968
Metals: Iron and steel	r 289	295	256
NONMETALS			
Cement	r 3,688	1,891	282
Salt	75,425	82,244	89,701
MINERAL FUELS AND RELATED MATERIALS			
Coal	20	--------	--------
Petroleum refinery products:[1]			
Gasoline—thousand 42-gallon barrels	3,953	2,735	2,673
Kerosine and jet fuel—do	5,164	3,842	4,194
Distillate fuel oil—do	7,150	6,151	3,714
Residual fuel oil—do	7,555	11,791	14,984
Other, including LPG and feedstocks—do	4,377	2,811	4,329
Total—do	28,199	27,330	29,844

r Revised.
[1] Apparent exports and reexports.

Table 14.—Southern Yemen: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	1968
Metals: Iron and steel	r 7,455	6,810	3,725
Nonmetals: Cement	r 61,300	37,169	35,518
MINERAL FUELS AND RELATED MATERIALS			
Crude petroleum—thousand 42-gallon barrels	51,276	41,245	34,994
Petroleum refinery products:e			
Gasoline—do	777	244	1,100
Distillate fuel oil—do	741	224	} 1,100
Residual fuel oil—do	6,695	2,019	
Lubricants—do	12	10	10
Total—do	8,225	2,497	2,210

r Revised. e Estimate.

SYRIAN ARAB REPUBLIC [21]

The Syrian mineral industry remained insignificant as a foreign exchange earner in 1968; however, income from pipeline transit royalties of the Trans-Arabian Pipeline Co. (TAPline) and the Iraq Petroleum Company (IPC) amounted to about

[21] Prepared by E. Shekarchi.

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$57.6 million.[22] A new source of exchange was developed during the year when petroleum was produced in the country for the first time. It brought in about $14 million from barter and direct cash sales in 1968.

According to the official paper Al-Thawra, an agreement was signed between the Governments of Syria and Poland in 1968 which included, among other items, a triple superphosphate plant with a capacity of 100,000 tons per year; a glass factory with no specific capacity; and expansion of the present cement plants at Damascus, Homs, and Aleppo. Most of the financing will be by Poland, with the Syrian Government repaying its debts through exports of semimanufactured materials.

Table 15.—Syrian Arab Republic: Production of mineral commodities

Commodity	1964	1965	1966	1967 •	1968 •
NONMETALS					
Cement—thousand metric tons	635	r 674	r 682	600	610
Glass sand—do	NA	10	10	10	12
Gypsum—do	20	15	15	15	15
Salt—do	16	21	20	20	20
MINERAL FUELS AND RELATED MATERIALS					
Asphalt, natural—metric tons	36,000	56,900	60,000	60,000	60,000
Petroleum:					
Crude—thousand 42-gallon barrels	------	--------	--------	--------	9,720
Petroleum refinery products:					
Gasoline—do	1,228	1,298	1,418	1,434	NA
Kerosine and jet fuel—do	938	1,131	1,116	1,346	NA
Diesel fuel—do	2,138	1,939	2,099	1,842	NA
Residual fuel—do	2,582	2,777	2,792	3,067	NA
Asphalt—do	185	180	190	351	NA
Liquefied petroleum gas—do	92	96	69	80	NA
Total refinery products—do	7,108	7,416	7,684	8,120	NA

• Estimate. r Revised. NA Not available.

Table 16.—Syrian Arab Republic: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Iron and steel:		
Scrap	3,999	1,045
Semimanufactures	38	62
Lead, scrap and semimanufactures	10	16
NONMETALS		
Abrasives, all types	80	56
Gypsum	26,336	16,900
Talc	174	30
MINERAL FUELS AND RELATED MATERIALS		
Asphalt	300	290
Petroleum refinery products: Gasoline thousand 42-gallon barrels	321	255

The small mineral production of the Syrian Arab Republic in 1968 showed little variation from the previous year. The only significant change was the successful production and export of crude petroleum from the northeastern fields of Suwaidiyah. Information on mineral production since the June 1967 conflict in the Middle East has been scarce and production statistics from an official source have not been made available. Estimated production figures on cement and glass sand indicated a slight increase, and with completion of the Homs refinery in 1969, production of refinery products will increase substantially in the future.

Although no official production figures were made available, it is estimated that the daily average production rate of crude oil was about 27,000 barrels. Suwaidiyah crude oil reportedly has 25° API gravity and 3.5 percent sulfur content, and can be mixed with some of the light crudes produced in northern Africa. Recoverable reserves of Suwaidiyah the largest of all three oilfields in Syria, have been estimated at about 1 billion barrels (150 million tons). By the end of 1968, there were 30 producing wells in the Suwaidiyah field.

In the northeastern part of the country, in addition to Suwaidiyah field, there are the Karatchuk and Rumaila oilfields which

[22] Where necessary, values have been converted from the Syrian pound (S£) at the rate of S£3.82=U.S.$1.00.

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Table 17.—Syrian Arab Republic: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum:		
Unwrought and scrap	118	70
Semimanufactures	1,740	1,297
Copper:		
Ingots, including scrap	9	42
Semimanufactures	1,131	917
Gold, platinum, and alloys troy ounces	6,352	10,624
Iron and steel:		
Pig iron	1,331	1,055
Scrap	946	317
Semimanufactures	126,688	209,012
Lead:		
Ingots	228	380
Semimanufactures	124	104
Silver troy ounces	8,414	------
Tin:		
Ingots long tons	90	56
Semimanufactures do	116	------
Zinc, all forms	212	265
NONMETALS		
Abrasives, all forms	365	175
Asbestos	5,100	1,108
Cement	15,279	8,896
Chalk	1,215	285
Clays	126	687
Fertilizers (minerals and chemicals)	82,363	60,011
Fuller's earth	6,564	------
Graphite	52	15
Magnesite	10	31
Marble	2,671	1,927
Ocher and other earth colors	66	20
Salt	29,308	13,484
Sand (including quartz)	991	1,007
Stone, building	1,278	1,250
Sulfur	2,043	60
Talc	780	170
MINERAL FUELS AND RELATED MATERIALS		
Asphalt	2,336	1,381
Coal (including briquets)	615	1,233
Coke	2,884	1,088
Petroleum:		
Crude thousand 42-gallon barrels	7,859	6,790
Refinery products:		
Gasoline do	70	35
Kerosine do	58	67
Diesel fuel oil do	7,473	------
Lubricants do	159	1
Liquefied petroleum gas do	6	15
Other do	4	1
Total do	7,770	119

did not produce until mid-1968. The pipeline, which was reported to be complete by the end of November 1968, should have connected both of these fields to the main trunkline. Karatchuk oil was known to have a 20° API gravity with about 4 percent sulfur content. No detailed information on the reserves of crude oil from the Karatchuk or Rumaila fields were available by yearend 1968.

The Syrian pipeline from the northeastern oilfields to Homs refinery and the port of Tartous on the Mediterranean went on stream in April 1968; however, at yearend, Syrian officials invited international bids for raising the throughput capacity of the 18/20/22-inch 650-kilometer pipeline. The Syrian plans envisage increasing the pipeline's annual throughput capacity from the present 4.5 million tons to 7.5 million tons for the length of the line from the oilfields to the Homs refinery, and from 2.1 million tons to 4.5 to 7.5 million tons for the length of the line. Increased pumping capacity will apparently be provided by additional booster stations.

The expansion of Syria's only refinery, the state-owned Homs facility which started in 1967, was delayed in 1968 due to difficulties with material supply and management. After modernization, it is expected that Syria will be self-sufficient in gas oil and kerosine. The cost of modernization is given at about $35 million with an additional $4 million in training and supervision costs. Homs refinery is expected to begin test runs in June 1969.

With the opening of Syria's new pipeline, the Government moved to deepen the Tartous port to enable 25,000-ton ships and tankers in the 50,000-ton range to use it. Apparently the Suez Canal Authority (SCA) is performing the task at a cost of about $1.2 million. The completion date was given as the latter part of 1969.

TRUCIAL STATES [23]

The Trucial States are a group of seven independent States (sheikhdoms) consisting of Abu Dhabi, Dubai, Sharjah, Ajman, Umm al-Qaiwain, Ras al-Khaimah, and Fujairah, each having a special treaty relationship with the United Kingdom. With the announcement in 1967 that the United Kingdom would sever these long-term arrangements and withdraw its armed forces from the area by the end of 1971, the various States made plans for a federation to include also the States of Bahrain and Qatar. On February 28, 1968, these nine states formally joined in federation and a committee was selected to prepare a constitution.

[23] Prepared by David A. Carleton.

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Petroleum and natural gas are the only significant minerals produced in the Trucial States, other mineral resources being essentially undeveloped. Only Abu Dhabi and Dubai have proved petroleum reserves, however, all the others either have exploration concessions or are negotiating for them. Most of the sheikhdoms have been influenced by the discovery and production of petroleum with the result that economic development programs are slowly introducing modern amenities to these underdeveloped States.

Abu Dhabi, with possibly the world's highest per capita income, received $192 million from the oil companies in 1968 as taxes and royalties, including certain retroactive payments and bonuses.

A 5-year plan[24] proclaimed by the Ruler of Abu Dhabi in March 1968 envisages the expenditure of $621.5 million on economic development. Infrastructural projects include the construction of roads, a new harbor, an international airport, water, sewage, and power facilities, and a variety of public facilities and buildings. Approximately $70 million of the total will be allocated for industrial projects, including the construction of a gas liquefaction plant, a petrochemical plant, and a crude oil topping unit. Projects under construction, but separate from the plan are a 100,000-ton-per-day cement plant at Buraimi, and a 75-mile, 18-inch natural gas line from Bu Hasa field to Abu Dhabi town. The line, which is being built by an Italian-Yugoslav joint venture, will supply fuel to the town's new powerplant. The only other known nonpetroleum mineral development in the Trucial States is a cement plant envisaged for Dubai.

Reportedly, the British Ministry of Overseas Development sponsored a preliminary minerals survey of the Trucial States that revealed traces of iron ore, copper, asbestos, chromite, and other metals. A more comprehensive survey was recommended to determine the feasibility of exploitation.

PRODUCTION

Small quantities of brick, sand, and stone were produced and consumed as building materials, but statistical data are not available. Both onshore and offshore petroleum production recorded large gains, as total output in 1968 averaged 496,600 barrels per day, a 30-percent increase over 1967 production. Abu Dhabi production equaled 1.3 percent of world crude oil output, ranking 12th in the world and fifth in the Middle East.

[24] The Times (London). The Union of Arab Emirates. Supplement. Mar. 3, 1969, pp. 4–5.

Table 18.—Trucial States: Production and imports of crude petroleum and petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1964	1965	1966	1967	1968
Production:					
Crude petroleum	67,465	102,804	131,531	139,467	181,756
Imports:					
Petroleum refinery products:*					
Gasoline	160	170	200	220	300
Kerosine	20	20	20	25	50
Distillate fuel oil	190	200	220	250	300
Lubricants	8	8	8	10	15

* Estimate.

TRADE

Major trade in mineral commodities included crude petroleum exports, petroleum refinery products imports, gold and silver transshipments, and construction material imports. There are no official publications in the Trucial States that give trade by volume. The only reliable data cover the oil items which are reported by the producing companies.

Concomitant with production increases, crude petroleum exports rose a sharp 30 percent during 1968 as there are no refineries in the Trucial States. Principal destinations in 1966 (latest available) were West Germany, 22 percent; France, 21

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percent; United Kingdom, 11 percent; and Southern Yemen, 7 percent. Western Europe received 62 percent of the total in 1966.

In 1968 Dubai merchants bought $134 million worth of gold at an average price of about $39 an ounce, most of it to smuggle into the Indian subcontinent.[25] Based on 1967 data, imports of petroleum products and construction materials into Dubai were valued at $10 million or 10 percent of the value of all imports. In addition about $2 million of oilfield materials were imported that year.

COMMODITY REVIEW

Mineral Fuels.—*Petroleum.*—The major development in the offshore concession of Abu Dhabi Marine Areas, Ltd. (ADMA), where production averaged about 181,000 barrels per day in 1968, was the completion of a second tanker berth at Das Island. Umm Shaif field continued to be the largest producer, with 120,000 barrels daily while Zakum made up the remainder. El Bunduq field remained shutin throughout the year awaiting international boundary determinations. Early in 1969 the Government of Qatar and Abu Dhabi announced agreement on the demarcation of their offshore areas. The boundary crosses El Bunduq field which will be developed by ADMA in accordance with its concession arrangements with the ruler of Abu Dhabi. Revenues from the field will be shared equally between Abu Dhabi and Qatar.

Onshore, Abu Dhabi Petroleum Co., Ltd. (ADPC), performed detailed seismic surveys employing the most modern recording equipment. Exploration drilling totaled about 64,000 feet in 1968 and included wells in the Ruwais and Shuweihat areas of western Abu Dhabi. ADPC drilled one unsuccessful well in the offshore territorial waters. Completion of two storage tanks in Jebel Dhanna will aid in increasing production.

Phillips Petroleum Co., operator of the 3.5 million acre land concession it shares with Ente Nazionale Idrocarburi (ENI) and American Independent Oil Co. (Aminoil) abandoned its first exploratory well 56 miles south of Jebel Dhanna at a depth of 10,000 feet. Plans are to drill a second well 12 miles south of the first well.

The Abu Dhabi Oil Co., a consortium of three Japanese refining companies, performed geophysical work in its 1.2 million acre offshore concession. At yearend plans were to drill a well 40 miles east of Abu Dhabi town.

On May 14, 1968, the Mitsubishi group of companies from Japan was granted the fifth oil concession let in Abu Dhabi. The 1.8 million acre concession area covers three land areas relinquished by ADPC earlier in the year. Geophysical exploration work began during the latter part of 1968.

A 2-billion-cubic-meter natural gas liquefaction plant at Abu Dhabi was under consideration by ADPC and two Japanese firms.

The offshore 820,000-acre concession of Dubai is owned 50 percent by Dubai Marine Areas, Ltd. (two-thirds British Petroleum Co. Ltd. and one-third Compagnie Française des Pétroles), 35 percent by Dubai Petroleum Co. (the concession operator which is a wholly owned subsidiary of Continental Oil Co.), 10 percent by Deutsche Erdöl, A.G. (a Texaco, Inc., subsidiary), and 5 percent by Sun Oil Co. Development drilling of the Fateh field, found 60 miles offshore in 1966, continued with the completion of two multiwell drilling platforms. At the end of 1968 work was proceeding on the construction of two more platforms and a unique offshore oil storage complex. The latter consists of floating tankers for storage (combined capacity 500,000 barrels) and an underwater storage tank which when completed will also have a 500,000-barrel capacity. The latter will be a circular, dome-shaped, open-bottom unit, having a height of 205 feet and a diameter of 270 feet. The unit will operate on the water displacement principle; that is, as oil is pumped into the tank, water will be forced out the bottom, and as oil is pumped from the unit, water will flow in from the bottom. This complex eliminates the need for expensive pipelines to the shore and from the shore to offshore tanker loading terminal. Production of Fateh field at a rate of 100,000 barrels per day is expected to begin during the latter part of 1969.

The 914,000-acre Dubai onshore concession is owned by Dubai Petroleum Co., 55 percent; Deutsches Erdöl A.G., 22.5 per-

[25] The Times (London). The Union of Arab Emirates, Supplement. Mar. 3, 1969, p. 14.

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cent, and Sun Oil Co., 22.5 percent. Onshore developments were not reported for 1968.

There was no petroleum exploratory activity in the Sheikhdoms of Sharjah, Ajman, and Umm al-Qaiwain during 1968. Four unsuccessful wells have been drilled in these States, three of them by John W. Mecom in a venture with Union Oil Co. of California. At the end of 1968 the ruler of Sharjah was expected to sign separate petroleum concessions with a subsidiary of the Royal Dutch/Shell group of companies and with Bochumer Mineralölgesellschaft G.m.b.H. and Co. (Bomin), a West German marketing firm.

The first well in the Sheikhdom of Fujairah was spudded 30 miles offshore in the Gulf of Oman by a subsidiary of the Royal Dutch/Shell group of companies, which entered Fujairah in 1968 by acquiring a 60-percent interest in a concession held by Bomin.

Union Oil Co. of California, which holds 80 percent and is the operator of an offshore concession it holds with Southern Natural Gas Co., completed a geophysical survey and spudded its first offshore Ras al-Khaimah well 24 miles northeast of Ash-Sha'am in 300 feet of water from a fixed platform.

YEMEN [26]

Little new information has been reported on the small mineral industry of Yemen. The production of rock salt, which has especially fine qualities, continued as the only mineral industry in Yemen. Virtually all the production was exported to Japan. No data has been reported on the cement plant that was slated for construction at Bajil in 1967.

Essentially all requirements for mineral commodities were met with imports, except perhaps certain simple construction materials. Petroleum refinery products were Yemen's principal imports, and with peace virtually universal in Yemen during the entire year, imports in 1968 rose considerably over those in 1967. All products were believed imported from Southern Yemen. Based on the value of exports from Southern Yemen to Yemen, imports were between 500,000 and 600,000 barrels in 1968. Most of these imports were motor gasoline and distillate fuel oil. Estimated value of petroleum imports into Yemen in 1968 was $2.0 million.

The Salif Salt Co. continued as the only major salt producing company in Yemen. Estimated salt production during recent years was as follows:

Year	*Metric tons*
1962	150,000
1963	100,000
1964	85,000
1965	-------
1966	85,000
1967	100,000
1968	85,000

Japan received 101,983 and 85,017 tons of rock salt from Yemen in 1967 and 1968, respectively. The c.i.f. value in Japan for these imports was $1.1 and $1.0 million, respectively.

There have been no announcements of petroleum exploration activity in Yemen in 1968, and there were no indications that exploration has ensued an earlier preliminary survey of mineral resources.

[26] Prepared by David A. Carleton.

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The Mineral Industry of Other Far Eastern and South Asian Areas

By Staff, Division of International Activities

CONTENTS

	Page		Page
Afghanistan	953	Laos	963
Brunei	955	Mongolia	963
Cambodia	956	Singapore	965
Ceylon	957	North Vietnam	968
Hong Kong	959	South Vietnam	969

AFGHANISTAN [1]

Natural gas became the most important area of industrial activity in the country during 1968. However, this development had little direct internal effect in bolstering the overall economy since the natural gas was exported solely to the U.S.S.R. Preliminary reports showed continued declines in imports and Government revenues, and it was evident that the Afghan economy remained in a general state of sluggishness.

During 1968, an estimated 53 billion cubic feet of natural gas was produced and delivered to the U.S.S.R. via three newly opened gas pipelines, leading from Shibarghan area gasfields to the Soviet border, and to Masar, Afghanistan site of an unfinished powerplant. Natural gas production is planned to reach 70 billion cubic feet in 1969. An 18-year agreement between the U.S.S.R. and the Afghan Government, which began in 1968, called for 53 billion cubic feet per year to be delivered to the U.S.S.R. in partial payment for Soviet financial and technical aid in developing Afghanistan's natural gasfields and in other projects. Reserves in 1968 of the Shibarghan fields were estimated at 5,500 billion cubic feet.

Drilling for gas continued at the Khwaja Gogirda and Yatim structures in the Shibarghan area and samples showed several favorable indications of commercial quantities of gas. On October 1, 1968, the U.S.S.R. and Afghanistan signed an agreement to study the expansion of gas operations at Khwaja Gogirdak and Yatim Tagh and for the exploitation of natural gas at Khwaja Burham.

In 1968 the Karkar coal mine, with a production of about 300 tons per day, provided most of the coal for Afghanistan. Half of Karkar's output went to the Ghouri cement plant. Lesser quantities of coal reportedly came from the Ishpushta and Darra-i-Suf mines. The largest coal deposit, however, is said to be the Darra-i-Suf mine, now being developed, which has estimated reserves of more than 60 million tons. The mine is scheduled to increase production to about 30,000 tons per year in 1969.

During 1968, France and Afghanistan signed an agreement to study the feasibility of exploiting the latter's 2-billion-ton Hajigak hematite deposit, located 85 miles northwest of Kabul, the nation's capital. Studies of the lead and zinc deposits in northern Afghanistan were made by the Afghan Ministry of Mines and Industries and the West German firm of Bergbau-Planung-G.m.b.H. Major activities consisted of the start of underground develop-

[1] Prepared by Ta Cheng Li, mining engineer.

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ment work and mapping at Nalbandan and of mapping and exploratory drilling of outcrops at Serghol.

Other important mineral commodities produced in 1968 were salt and lapis lazuli. Continued interest was shown in exploration for chromite, beryl, copper, and uranium. Although the Afghan Government continued to encourage foreign assistance in feasibility studies and in developing minerals, activities will be hampered by the country's inadequate transportation and capital.

Investments of $550 million were called for in Afghanistan's third 5-year plan which became effective on March 22, 1968. Ninety percent of these investments will come from foreign sources. A third of the total amount will be allocated to Afghan mines and industry.

The first private investment venture undertaken as a result of incentives embodied in the 1967 investment law was a Pakistani-owned iron foundry. Located outside of Kabul, the small plant began operations in November converting scrap metal into iron rods. Its rerolling capacity is 3,000 tons per year. Also, a new cement plant will be built at Herat as the result of an agreement reached between the Afghan Government and a Czechoslovakian firm in 1968. This third plant will help Afghanistan meet most of its cement needs, and complement two other cement plants already in existence at Ghouri and Jabal-i-Seraj.

Table 1.—Afghanistan: Production of mineral commodities[1]

Commodity	1964	1965	1966	1967	1968
NONMETALS					
Cement, hydraulic---thousand metric tons	• 125	170	175	130	• 177
Gemstones: Lapis lazuli---kilograms	5,000	8,550	10,080	5,179	• 10,000
Salt:					
Rock---thousand metric tons	13	18	20	31	• 40
Brine---do	12	20	18	--------	--------
Total---do	25	38	38	31	• 40
MINERAL FUELS AND RELATED MATERIALS					
Coal, bituminous---thousand metric tons	113	132	141	152	• 200
Fuel briquets, all grades---do	• 20	• 14	21	NA	NA
Natural gas, marketed---billion cubic feet	--------	--------	--------	18	53

• Estimate. NA Not available.
[1] All data except 1968 natural gas for Afghan calendar year beginning March 21 of year indicated.

In 1968, Afghanistan exported only two mineral commodities, lapis lazuli to West Germany and mainland China and natural gas to the U.S.S.R. as mentioned before. For the first time, the U.S.S.R. agreed to import an Afghan manufactured product, announcing in December that it would import 30,000 tons of cement in 1969. Dependence on imports continued for petroleum products, metals, and most nonmetallics.

On May 13, 1968, the United States granted Afghanistan a $12 million loan to be used for the installation of a hydroelectric power station at the Kajakai Dam, located on the Helmand River. Construction, due for completion in 1969, continued at the U.S.S.R.-financed plant at Naghly near Kabul and at the West German-financed plant at Mahipar. With the completion of these electric power projects, Afghanistan will have a capacity of 300,000 kilowatts, one-third more than its present capacity.

Table 2.—Afghanistan: Imports of petroleum refinery products

(Thousand 42-gallon barrels)

Commodity	1965–66[1]	1966–67[1]	Principal sources, 1966–67
Gasoline	962	NA	U.S.S.R.
Kerosine	142		
Distillate fuel oil	507		
Lubricants and other	49		

[1] Afghan calendar year beginning Mar. 21.

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BRUNEI [2]

Crude oil production was essentially the only developed mineral resource of Brunei. Natural gas was produced in significant quantities, but over two-thirds of the gas produced was used for gaslifting purposes. Small amounts of natural gas were exported to Sarawak by pipeline. Brunei Shell Petroleum Co., Ltd. was the only producing oil company, but there were two other concessionaire companies in addition to Shell.

Crude oil production during 1968 again registered a substantial increase, primarily due to increased production from the relatively new oilfield, Southwest Ampa. The old established Seria oilfield registered little or no increase over the 1967 production level. Practically all of Brunei's crude oil production was sent by pipeline to Lutong, Sarawak, for refining or export. Small amounts were processed at a small topping plant at Seria to obtain limited quantities of motor gasoline, naphtha, and fuel oils for consumption in Brunei. Additionally the natural gas stabilization plant produced natural gasoline and liquefied petroleum gas.

Brunei's overall trade balance remained favorable during 1967, with a positive balance of $70 million. As in past years, crude oil exports, all to Malaysia (Sarawak), accounted for virtually the total value of mineral commodity exports. Imports of semimanufactured iron and steel products, valued at $3.4 million, was the major mineral commodity import.

The value of total, mineral commodity trade, and the net trade balance of Brunei for 1966–67 are as follows:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total trade	
Exports and reexports:			
1966	71	74	95.9
1967	79	81	97.5
Imports and reimports:			
1966	10	52	19.2
1967	9	45	20.0
Balance:			
1966	61	22	XX
1967	70	86	XX

XX Not applicable.

During 1967 Brunei shipped 35,901,000 barrels of crude oil to Sarawak, Malaysia, as well as limited amounts of refined products, as follows:

Product	Thousand 42-gallon barrels
Gasoline	461
Kerosine	3
Distillate fuel oil	20
Other	3
Total	487

[2] Prepared by Arthur F. Grube, industry economist.

Table 3.—Brunei: Production of mineral fuels

(Thousand 42-gallon barrels unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
Natural gas, gross production, million cubic meters •	1,200	1,328	1,989	2,633	3,216
Liquefied petroleum gas	NA	NA	NA	NA	196
Petroleum:					
Crude oil	25,913	28,991	r 34,626	37,961	44,664
Natural gasoline	633	546	533	553	535
Refinery products:					
Motor gasoline	102	110	138	113	107
Naphtha	56	49	48	• 20	19
Distillate fuel oil	99	110	148	123	150
Residual fuel oil	254	201	234	5	5
Total	511	470	568	261	281

• Estimate. r Revised. NA Not available.

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The only other significant mineral commodity exports included 1,813 metric tons of iron and steel, all forms, primarily to Singapore, Malaysia, and Hong Kong; and exports of liquefied petroleum gas valued at $367,709, to Sarawak, Malaysia.

Significant mineral commodity imports included semimanufactured iron and steel products amounting to 14,017 metric tons, primarily from Singapore, Japan, and the United States; gold imports from the United Kingdom amounting to 61,117 troy ounces; and cement imports of 40,167 metric tons, primarily from Belgium-Luxembourg, Singapore, and Malaysia. Brunei also imported limited amounts of petroleum products, virtually all from Singapore, as follows:

Product	Thousand 42-gallon barrels
Gasoline	25
Kerosine	13
Asphalt	10
Other	14
Total	62

Liquefied petroleum gas valued at $28,829 was also imported, primarily from Sarawak, Malaysia.

During 1968 new tax and royalty agreements were consummated between the Government and Brunei Shell Petroleum Co., Ltd.; according to the new agreements the payment of royalties by the oil company would be charged to accounts before the determination of profits, rather than as in the past deducted from the 50-percent profit tax. Additionally, the price at which oil is valued will be based on posted prices rather than realized prices. The Shell Company agreed that the new arrangement would take effect from January 1, 1964, and agreed to pay the Brunei Government back taxes in the amount of $34 million.

On November 12, 1968, the U.S. firm, Ashland Oil and Refining Company, was granted drilling and exploration rights to a 1,139.2-square-mile concession area. The area covers virtually all the land area that is not at present held by either Brunei Shell Petroleum Co., Ltd., or Clark Oil Company. Shell has a 385-square-mile onshore concession and about 3,000 square miles offshore, and Clark Oil Company holds 702 square miles onshore.

At yearend 1968 Brunei Shell Petroleum Co., Ltd., continued negotiations with the Mitsubishi Trading Company regarding the sale of liquefied natural gas to Japan. The two companies are now in the process of finding Japanese customers for the gas. Gas would be supplied on a 20-year contract at the rate of 260 million cubic feet per day commencing in 1972.

CAMBODIA [3]

The Cambodian mineral industry in 1968 produced only small quantities of gold, phosphate rock, limestone, precious and semiprecious stones, salt, cement, and simple construction materials.

The most significant Cambodian industrial achievement in 1968 was the completion of a 12,000 barrel-per-day oil refinery, financed by a $12 million dollar French loan. The crude oil input is to come from Algeria. The refinery will start operation in January 1969 and will be managed by the Cambodian controlled Société Khumere de Raffinage. The state-managed National Cement Company's expansion program for its cement plant in Chakrey Ting near Kampot neared completion and is expected to raise annual output from the present 50,000-60,000 tons to 150,000 tons.

The second 5-year development plan, which should have been launched in 1967, barely got off the ground in 1968, owing to lack of financing. The plan called for $9.1 million, $2.3 million of which would go to industrial projects, including a new cement plant with an annual capacity of 200,000 tons, a steel mill using scrap iron to produce wire and concrete reinforcing rods, and a 35,000-ton-per-year urea plant. Technical surveys for these projects were underway in 1968.

Cambodia's new mining law promulgated in 1968 proclaimed that minerals onshore and on the Continental Shelf were the property of the state. Mining exploration permits are for 3 years, renewable for an additional 3 years. Mining concessions are

[3] Prepared by Ta Cheng Li, mining engineer.

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for 4 to 50 years, and depending on importance of the minerals, renewable for two periods of 5 to 25 years. Permits and concessions can only be granted to Cambodian citizens, although through a special decree by the Council of Ministers they can be granted to foreigners. The permit holder has exclusive right to exploration, as well as the right to obtain a subsequent mining concession. Hydrocarbon exploration permits are for 5 years and concessions are for 40 years, with a possibility of renewal for an additional 25 years. Total area allowed for each person to explore and exploit hydrocarbons is limited to 5,000 square kilometers onshore, and 10,000 square kilometers offshore.

In August 1968 Prime Minister Penn Nouth issued a circular aimed at promoting private investment, national or foreign, in mineral commodities such as urea, cement, and steel products. Investments would be guaranteed against nationalization for periods up to 20 years. Investors, among other advantages, would be exempt from taxes at first and could benefit from loans, while local markets would be protected against imports.

In another move to promote investment, on August 16 the creation of a free zone at Sihanoukville Seaport was announced; the seaport was opened to all countries, with all necessary facilities and guarantees for investors. The regulations would be similar to those in such free zones as Beirut or Tangiers. The free zone is planned to be officially opened in April 1969.

Although data on mineral commodity trade for 1967 are not available, it was almost certain that mineral commodity exports remained inconsequential while mineral commodity imports continued to account for a significant share of total trade. Major imports in 1967 probably consisted primarily of iron and steel, cement, coal, and petroleum refinery products. Japan, mainland China, Indonesia, and Singapore are Cambodia's principal trading partners.

Generation capacity for electric power was being expanded primarily by the installation of hydroelectric plants. The 10,000-kilowatt Kirirom powerplant, completed with Yugoslav assistance in late 1967, was inaugurated in March 1968. Construction continued on the Kam Chay plant scheduled for completion in 1969, and funds were obtained in late 1968 for the construction of the Prek Thnot Dam and hydroelectric complex on the Lower Mekong River.

CEYLON [4]

Graphite, ilmenite, and precious and semiprecious stones remained Ceylon's principal contributions to the world mineral supply. Total value of mineral commodities produced in Ceylon in 1968 was estimated at $10.7 million. Ceylon produces a very special high-quality type of lump graphite, highly prized in world markets. Production has remained somewhat steady at around 10,000 tons per year.

Ceylon's 1968 cement industry ranked ahead of the graphite industry in value of output and registered a 15.7-percent increase in output due to the recent modernization of the Kankesanturai plant and the establishment of a new plant at Puttalam.

In 1968 ilmenite production reached a peak level of 74,600 tons, virtually all of which was exported to Japan. All ilmenite production came from the state-owned Ceylon Minerals Sand Corporation's (CMS) deposit at Pulmoddai, located on the northeast coast. At the deposit, the sands extracted are replaced each year by new deposition during the monsoon period, thereby enabling reserves, placed at 4 to 5 million tons, to remain virtually constant. With the completion in 1969 of CMS's second plant, located at Trincomalee, 30 miles south of Pulmoddai, ilmenite production in Ceylon is expected to reach 100,000 tons per year. The plant will also recover from the ilmenite tailings 10,000 tons per year of both rutile and zircon, and 500 tons per year of monazite.

During 1968 over 50 percent of the civil engineering works were completed on the nation's first oil refinery located at Colombo. Construction of this project began in early 1967 but because of delays completion is not expected until June 1969. Sufficient to meet Ceylon's anticipated needs, the reported capacity of the refinery will be 38,000 barrels daily. The operator of the refinery, the Government-owned Ceylon

[4] Prepared by Ta Cheng Li, mining engineer.

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Table 4.—Ceylon: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Rare-earth metals, monazite concentrate, gross weight	23	36	36	20	42
Titanium, ilmenite concentrate, gross weight	46,158	49,189	r 41,198	52,298	74,605
Zirconium, concentrates (zircon), gross weight	50	36	151	118	25
NONMETALS					
Cement, hydraulic	75,000	85,850	82,880	188,741	221,986
Clays, kaolin	1,500	816	1,616	2,574	2,867
Feldspar, crude and ground	50	615	419	256	586
Gem stones, precious and semiprecious, except diamond (exports)—carats	NA	71,254	61,119	24,906	196,039
Graphite, all grades (exports)	10,847	8,880	10,025	10,203	10,527
Quartz, glass sand	4,000	7,100	5,410	3,272	3,058
Salt, all types	52,000	78,200	64,486	74,610	98,391

r Revised. NA Not available.

Petroleum Corporation, agreed in late 1968 to purchase from Consolidated Petroleum Supply Company (a consortium of Royal Dutch Shell and British Petroleum interests) 50 million barrels of crude oil over a 5-year span. Technical assistance in operating the refinery was included in the agreement.

During 1968 an agreement was reached with the U.S.S.R. to proceed with construction of two additional phases (pig iron manufacture and crude steelmaking) of the planned integrated steel plant in Ceylon. The first phase, a steel rolling mill with an annual capacity of 60,000 tons of rolled steel was opened in 1967. Construction of the cast iron foundry in Enderamulla will be completed in early 1969. The foundry, a West German and Ceylon venture, will have an annual capacity of 18,000 tons on a three-phase basis.

With a governmental budgetary allocation of $25 million and help from an Indian advisory staff, site work was expected to start in late 1968 on the State Fertilizer Manufacturing Corporation's 540-ton-per-day fertilizer plant. The plant will utilize naphtha, from the still unfinished oil refinery, to manufacture urea. Ceylon is almost wholly dependent on imported manufactured fertilizers to sustain her predominantly agricultural economy.

Even though the volume of exports rose in 1967, declining export prices caused the total value of Ceylon's exports to fall to $84 million, the lowest figure recorded since 1957. Ceylon's 1967 mineral exports were valued at $2.58 million, of which ilmenite, graphite, and precious and semiprecious stones accounted for 95 percent.

Both the volume and value of Ceylon's 1967 imports fell to $292 million, a 14-percent drop from the 1966 figure. The value of mineral commodities imported in 1967 was close to $53 million, of which $24 million consisted of petroleum products, $16 million of manufactured fertilizers, $11 million of metals, and $2 million of cement.

On November 16, 1968 Ceylon's export duty on precious and semiprecious stones was abolished in order to encourage the gem industry to abide by the foreign exchange controls, thereby diverting current black market trade into official channels.

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Table 5.—Ceylon: Foreign trade in mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
EXPORTS		
METALS		
Rare-earth metals, ores and concentrates (monazite)	75	75
Titanium, ores and concentrates (ilmenite)	41,200	54,476
Zirconium, ore and concentrate (zircon)	51	100
NONMETALS		
Graphite, natural	10,025	10,203
Precious and semiprecious stones, except diamond—carats	61,119	24,906
IMPORTS		
METALS		
Aluminum, metal, including alloys, all forms	2,454	2,100
Copper, metal, including alloys, all forms	612	1,300
Gold, metal, unworked or partially worked—troy ounces	12,740	201
Iron and steel:		
Metal, pig iron, including cast iron	1,411	1,000
Semimanufactures	59,862	72,183
Lead, metal, including alloys, all forms	429	560
Tin, metal, including alloys, all forms—long tons	r 94	48
Zinc, metal, including alloys, all forms	293	640
NONMETALS		
Abrasives, natural, n.e.s	179	180
Asbestos	2,019	2,000
Cement—thousand tons	251	101
Fertilizer materials, manufactured:		
Nitrogenous—thousand tons	187	139
Phosphatic—do	48	28
Potassic—do	57	52
Other, including mixed do	35	59
Salt (excluding brines)	4,000	11,200
Sulfur, elemental, all forms	2,089	2,000
Talc	1,172	2,000
MINERAL FUELS AND RELATED MATERIALS		
Coal, all grades, including briquets thousand tons	31	138
Coke and semicoke	562	920
Petroleum refinery products:		
Gasoline thousand 42-gallon barrels	1,510	1,505
Kerosine—do	2,278	1,767
Distillate fuel oil—do	2,490	2,160
Residual fuel oil—do	2,374	2,077
Other—do	258	213

r Revised.

HONG KONG [5]

Hong Kong is an industrial-commercial area with an economy based on foreign trade rather than on internal resources. A significant portion of this trade includes mineral commodities imported for both local industry and reexport. In 1968 total value of Hong Kong's trade—imports, exports, and reexports—amounted to about $3.8 billion,[6] of which $417 million or 11 percent involved mineral commodities.

The extractive and processing sectors of Hong Kong's mineral industry contribute little to the colony's economy. Total value of Hong Kong's crude mineral output in 1968 was about $1.3 million, of which iron ore for export to Japan accounted for

[5] Prepared by Ta Cheng Li, mining engineer.
[6] All values are converted at the rate of HK$6.10 = US$1.

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nearly 90 percent. Small quantities of kaolin, quartz, feldspar, graphite, and wolframite were mined for domestic needs and/or for export. In addition, cement production based upon imported clinker was valued at $3.6 million. Additional unrecorded values were added by the steel rolling and gas manufacturing industries.

In 1968 Hong Kong's small steel rolling mills continued to experience difficulties, operating at only 40 percent of their capacity. This was caused by the importation of cheaper steel products into the colony from mainland China, increasing tariffs overseas, and continuing recession in the building industry. Toward the end of 1968, however, there were signs of a new burst of building activity, and plans were afoot for extensive government construction which should spur new demand for steel products in the colony.

Hong Kong had an excellent trading year in 1968. Exports were valued at $1.4 billion, which was both the highest ever reported in Hong Kong and a 25.8-percent increase over the 1967 value. Reexport goods also rose by 2.9 percent to $351 million, thereby swelling Hong Kong's total export and reexport trade value to $1.76 billion in 1968. The value of imports also increased to about $2 billion, a 11-percent increase over that in 1967. The following details the relationship between mineral and total trade:

	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities (including fuels)	Total trade	
Exports and reexports:			
1966	106	1,824	8.0
1967	104	1,537	6.8
1968	120	1,764	6.8
Imports:			
1966	289	1,767	16.4
1967	255	1,829	13.9
1968	297	2,080	14.6
Trade balance:			
1966	−183	−443	XX
1967	−151	−292	XX
1968	−177	−266	XX

XX Not applicable.

Mineral commodities imported in 1968 included principally $115.2 million worth of pearls, precious and semiprecious stones, $67.2 million of petroleum and petroleum products, $37.4 million of iron and steel, and $33.9 million of nonferrous metals.

Table 6.—Hong Kong: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Iron and steel, iron ore and concentrate—thousand tons	116	134	137	144	162
Tungsten, mine output, metal content	1	7	8	5	1
NONMETALS					
Cement, hydraulic—thousand tons	215	241	247	215	259
Clays, kaolin	5,124	4,787	5,863	8,570	5,664
Feldspar	1,581	1,137	1,865	1,158	1,607
Graphite, all grades	721	-------	-------	19	505
Quartz	1,649	1,939	2,892	3,048	3,693
MINERAL FUELS AND RELATED MATERIALS					
Coke, all types [1]—thousand tons	13	13	10	9	-------

[1] Production ceased at the end of 1967.

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Table 7.—Hong Kong: Exports and reexports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Aluminum, metal, including alloys, all forms	9,256	7,317	Taiwan 1,635; United Kingdom 1,259.
Copper, metal, including alloys, all forms	6,689	8,777	Japan 6,303; Taiwan 1,943.
Gold, metal, unworked or partly worked. thousand troy ounces	1,432	1,733	All to Macao.
Iron and steel:			
Ore and concentrate thousand tons	141	170	All to Japan.
Metal: Scrap do	115	133	Japan 90; Taiwan 37.
Semimanufactures:			
Exports do	72	88	Thailand 52; Japan 11.
Reexports do	28	30	Indonesia 18; Cambodia 4.
Lead, metal, including alloys, all forms	1,149	1,157	Taiwan 952.
Silver, metal, including alloys thousand troy ounces	882	897	Japan 747; United Kingdom 97.
Zinc, metal, including alloys, all forms	1,473	467	Mainland China 339.
NONMETALS			
Cement:			
Exports thousand tons	26	35	Cambodia 13.
Reexports do	69	53	Indonesia 43; Brunei 6.
Clays and clay products: Kaolin	3,987	4,900	Japan 2,574; Taiwan 2,266.
Diamond, gem, not set or strung thousand carats	150	171	Belgium 55; Israel 46; Japan 31.
Diatomite and other infusorial earths	46	19	Indonesia 9; India 5.
Feldspar and fluorspar	723	367	Philippines 160; Thailand 107.
Graphite, natural	456	84	Thailand 44; India 30.
Talc and related materials (soapstone)	550	750	Indonesia 560; Ghana 122.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum, refinery products:			
Gasoline thousand 42-gallon barrels	40	22	Mainly to Macao.
Kerosine do	37	42	All to Macao.
Distillate fuel oil do	r 214	249	All to Macao.
Lubricants do	115	131	Thailand 44; Singapore 31.
Other [1] do	r 96	103	Philippines 41; Taiwan 21.

r Revised.
[1] Mostly waxes.

Source: Hong Kong Trade Statistics. Exports and Reexports. Commerce and Industry Department, Hong Kong, December 1966, 500 pp.; December 1967, 515 pp.

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Table 8.—Hong Kong: Imports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum, metal, including alloys, all forms	11,265	15,656	Canada 4,065; Japan 2,387; Australia 2,389.
Copper, metal, including alloys, all forms	r 9,684	13,049	Japan 3,578; Indonesia 2,509; United Kingdom 2,043.
Gold, metal, unworked or partly worked	thousand troy ounces 1,372	1,756	United Kingdom 1,181; Australia 548.
Iron and steel:			
Ore and concentrates	12,294	2,016	All from mainland China.
Metal:			
Scrap	thousand tons 56	63	United Kingdom 31; West Germany 20.
Pig iron, including cast iron	14,002	3,050	North Vietnam 2,358.
Steel, primary forms	thousand tons 22	27	Australia 25.
Semimanufactures	do 418	316	Japan 102; mainland China 84.
Lead, metal, including alloys, all forms	1,311	675	North Korea 268.
Platinum	thousand troy ounces 26	48	United Kingdom 27; West Germany 15.
Silver, metal, including alloys	do 245	252	North Korea 109; United Kingdom 76.
Zinc, metal, including alloys, all forms	5,726	5,894	Australia 2,185; Canada 1,277; North Korea 1,089.
NONMETALS			
Cement	thousand tons 910	515	Mainland China 390; Japan 94.
Diamond, gem, not set or strung	thousand carats 461	457	Belgium 158; Israel 142.
Diatomite and other infusorial earths	311	320	United States 249.
Feldspar and fluorspar	1,740	2,898	Mainland China 2,298.
Fertilizer materials, manufactured	thousand tons 8	8	West Germany 6.
Gypsum and plasters	do 18	5	Pakistan 2, mainland China 1.
Lime	do 50	37	Mainland China 18; North Vietnam 9.
Salt and brines, salt	do 30	33	Mainland China 25.
Stone and gravel:			
Limestone (except dimension)	do 324	75	Japan 74.
Quartz and quartzite	3,118	3,710	Mainland China 3,682.
Talc and related materials (soapstone)	1,750	2,143	Mainland China 1,906.
MINERAL FUELS AND RELATED MATERIALS			
Coal, all grades, including briquets	thousand tons 150	116	Mainland China 72; Japan 24.
Coke and semicoke	5,305	5,485	Japan 3,881; mainland China 1,497.
Petroleum, refinery products:			
Gasoline	thousand 42-gallon barrels 802	828	Singapore 394; Bahrain 261.
Naphthas and solvents	do 168	253	Iran 163.
Kerosine	do 1,359	1,446	Japan 498; Singapore 443; Iran 294.
Jet fuel	do 1,258	1,575	Singapore 826; Iran 255; Saudi Arabia 253.
Distillate fuel oil	do 3,078	3,203	Singapore 1,535; Iran 686; Japan 531.
Residual fuel oil	do 9,414	11,886	Singapore 4,334; Iran 3,524; Saudi Arabia 2,849.
Lubricants	do 241	257	United States 95; Taiwan 73.
Other [1]	do 256	227	Indonesia 90; Singapore 86.

r Revised.
[1] Mostly waxes and asphalt.

Source: Hong Kong Trade Statistics. Imports. Commerce and Industry Department, Hong Kong. December 1966, 236 pp.; December 1967, 241 pp.

COMMODITY REVIEW

Metals.—*Iron and Steel.*—During 1968, the most active mining in Hong Kong continued to be at the magnetite iron ore mine at Ma On Shan in the new territories. In response to the increasing demand for iron ore in Japan, production from the Ma On Shan, Hong Kong's only iron ore mine, increased 13 percent in 1968 to 162,000 metric tons.

Nonmetals.—*Cement.*—The Green Island Cement Co., the sole cement manufacturer in Hong Kong, increased production by 20 percent in 1968 to 259,000 tons. This was the result of a year free from labor disputes and in which new building activities were started.

Mineral Fuels.—*Gas.*—The Hong Kong & China Gas Co., Ltd., awarded in 1968 a $600,000 contract to the Australian branch of Humphreys & Glasgow, Ltd., United Kingdom, for a gas production plant to be built at the company's Kowloon Works in Kowloon City. The plant, second of its kind in Hong Kong, will be used

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to meet the Colony's ever-increasing demand for manufactured gas. Its daily capacity will be 3.5 million cubic feet, surpassing present output by 40 percent.

LAOS [7]

Tin remained the only important mineral commodity produced in Laos during 1968. Virtually all production came from the French-managed Phon Tiou tin mines, located in southern Laos. Owing to the modernization of these mines in 1966, production of low-grade tin concentrates was expanded to about 1,250 tons in 1967, with estimates of 1968 production at about the same level. Available tin production data are as follows:

Year	Tin concentrate (long tons)	Tin metal content (long tons)
1964	686	336
1965	569	284
1966	668	340
1967	1,250	625
1968	•1,200	600

• Estimate.

Laos possesses a variety of other minerals such as coal and iron, which have been of considerable interest, but further studies have been hindered by the country's unsettled conditions.

Value of tin exports increased from $93,300 in 1966 to $157,300 in 1967. All of the tin is exported to Malaysia. Laotian mineral imports consist chiefly of petroleum products, cement, and iron and steel semimanufactures, and its principal trading partners are Thailand, Indonesia, and Malaysia.

Aside from the recorded mineral trade, Laos does a lucrative trade in gold, arising from a lack of governmental restrictions on amounts of gold entering or leaving the country. Gold is imported from West European countries and reexported to Asian countries such as Burma, Thailand, South Vietnam, and India. Preliminary estimates of 1968 gold imports were down to 1.0 million troy ounces from the 1967 level of 2.3 million troy ounces. The decline was attributed to the 1968 run on world gold stocks which forced prices up, and a slowdown of Laotian gold flow into Saigon, a principal purchaser, due to the 1968 Tet offensive. The Laotian government's principal source of local revenue is an 8½ percent tax on all gold imports, and an estimated drop of $3.75 million in 1968 receipts from the gold tax probably caused difficulties in financing the Laotian budget of $32 million.

MONGOLIA [8]

Mongolia's small mineral industry apparently made some progress in 1968, with reported gains of about 35 percent for all mining, and approximately 10 percent each for the fuels and construction materials industries. The country's first cement plant also came on stream. Despite these gains, a number of producing sectors and important facilities appeared to have barely met or even failed to achieve established goals. In addition, geological prospecting work for such minerals as tungsten, tin, copper, gold, and iron was seriously lagging.

In coal extraction, which accounts for an estimated 60 percent of mine output value, the claimed 15-percent rise in production still seems to have left this sector far short of the 280,000-ton increase that had been expected. The key Sharyn Gol open pit allegedly fulfilled an undisclosed goal, but was experiencing difficulties in stripping operations. Actual production was believed to have been much less than the 750,000 tons planned for it. As in most recent years Nalaikha, the country's only other important coal mine, failed by a wide margin to reach its target.

The important construction materials sector was credited with only having fulfilled about three-quarters of its goals. This allegedly was because neither the regular nor lightweight concrete mixing plants at Ulan Bator, or the recently completed lime and brick plants at Darkhan, met their quotas. The most important advance was the long-awaited completion of the first 100,000-ton-per-year stage of a cement

[7] Prepared by Ta Cheng Li, mining engineer.
[8] Prepared by Ronald A. Pense, research specialist.

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plant at Darkhan and the immediate commencement of work on a 100,000-ton expansion of that capacity in 1969. In recent years Mongolia has depended on imports from the U.S.S.R. for virtually all of its cement supply. During the year a pilot plant was established to produce gypsum from a 1.7-million-ton alabaster deposit newly discovered in Ubsa Province.

Production of fluorspar and tungsten, Mongolia's only mineral export items of any consequence, currently shipped entirely to the Soviet Union, apparently followed different courses in 1968. Based on recent trade data of the U.S.S.R. showing fluorspar imports of about 45,000 to 50,000 tons in the last few years and an apparent 20-percent increase in 1968 production, output of fluorspar probably reached at least the 60,000-ton-per-year level. Output of tungsten, however, only amounted to about half that expected at the main Burentsogt and Ih Hairhan mines. The increasingly difficult mining conditions being encountered at both mines was apparently responsible for falling ore grades and plans to extend the depth of mining operations. In addition, a new small pit producing 6,000 tons per year of ore was to be opened at Harchulut, apparently in the vicinity of Ih Hairhan.

No particular progress was reported during 1968 on the 300,000-ton-per-year integrated steel plant under construction at Darkhan. This, and a major reallocation near yearend of capital investment in favor of the agricultural sector of the economy which had been badly damaged by adverse weather conditions, seemed to indicate that construction on the plant had been unimpressive and probably would be further prolonged.

Table 9.—Mongolia: Production of mineral commodities [1]

(Thousand metric tons unless otherwise specified)

Commodity [2]	1964	1965	1966	1967	1968
NONMETALS					
Fluorspar, all grades	57	75	r 50	r 50	60
Gypsum (alabaster)	20	20	20	25	25
Lime	30	35	35	40	40
Salt, all types	8	8	8	8	8
MINERAL FUELS AND RELATED MATERIALS					
Coal [3]	710	990	1,004	1,060	1,250
Petroleum:					
Crude oil—thousand 42-gallon barrels	r 125	116	89	90	90
Refinery products:					
Gasoline—do	150	144	150	r 165	165
Distillate fuel oils—do	60	49	50	r 55	55
Residual fuel oil—do	205	r 205	r 192	r 220	220

r Revised.
[1] All figures estimated except coal and crude oil (1965–66); and gasoline and distillate fuel oils (1965).
[2] In addition to listed items, Mongolia produces simple construction materials and small amounts of tungsten concentrates.
[3] Mainly so-called brown coal.

No official Mongolian trade data are published. However, because at least 80 percent of total Mongolian trade is with the U.S.S.R., officially recorded Soviet trade statistics are believed highly indicative of total Mongolian mineral commodity trade. Imports of Mongolian fluorspar were given as 45,100 metric tons in 1966 and 46,500 tons in 1967. Small amounts of ferrous scrap and unspecified nonferrous ores and concentrates (undoubtedly including tungsten) are also imported. Exports to Mongolia in 1966 and 1967 included iron and steel products (7,900 tons and 12,300 tons, respectively) as well as small amounts of nonferrous metals, refractories, and coal and coke. Cement shipments, totaling 58,000 tons in 1966 and 50,000 tons in 1967, probably were reduced to relative unimportance in 1968 with the completion of the new cement plant at Darkhan. The principal Soviet trade contribution to the Mongolian mineral economy remains the supply of crude oil to keep the small Dzuun Bayan refinery operating at full capacity, and petroleum products which account for the greater part of indigenous demand. Together these totaled about 1.6 million barrels in 1966 and 1.8 million barrels in 1967.

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Table 10.—Mongolia: Imports of petroleum from the U.S.S.R.

(Thousand 42-gallon barrels)

Commodity	1966	1967
Crude	331	353
Refinery products:		
Gasoline	819	879
Distillate fuel oil	332	453
Lubricants	86	78
Other	r 19	24
Total	1,587	1,787

Source: Data derived from official export statistics of the U.S.S.R.

SINGAPORE [9]

Singapore's economy continued to show satisfactory progress during 1968. Gross national product, at current market prices, increased from $1,181 million in 1966 to $1,285 million in 1967. An increase of similar magnitude was expected during 1968. Overall foreign trade, imports plus exports, increased nearly 14 percent over that of 1967. As in past years, however, Singapore's balance of trade remained unfavorable, with imports exceeding exports by $390 million.

Singapore does not have a significant extractive mineral industry; however, the metal-working industry has been growing at an extremely rapid rate. According to the Singapore Investment Center there were about 150 metal producing or fabricating plants in Singapore as of October 1968. The plants range in size from iron and steel mills, to foundries, to piece-work shops.

At yearend 1968 construction work was well underway on a new thermal power station at Jurong. The new plant will have a maximum installed capacity of 480,000 kilowatts provided by four generating units of 60,000 kilowatts each and two units of 120,000 kilowatts each. The plant is expected to be completed by 1971. Singapore's production of electric power amounted to 1,639.4 million kilowatt-hours during 1968.

PRODUCTION

Singapore's mineral production is limited to oil refining, steelmaking, cement, and mining of granite for local construction. Cement production amounted to 388,000 metric tons in 1966, 471,000 tons in 1967, and 566,501 tons in 1968. Granite production in 1968 was 1,545,801 cubic yards. Refinery output of petroleum products for the 1966–68 period was as follows, in thousands of 42-gallon barrels:

Product	1966	1967	1968
Motor gasoline and naphtha	3,234	5,874	16,924
Kerosine and jet fuel	2,380	4,412	1,981
Distillate fuel oil	3,722	7,329	11,624
Residual fuel oil [1]	10,335	17,568	32,119
Other	246	779	1,164
Refinery fuel and loss	e 1,000	1,076	1,467
Total	20,917	37,038	65,279

e Estimate. [1] Includes unfinished fuel oils.

TRADE

Mineral commodities have been of increasing importance in Singapore's overall trade in recent years. Mineral exports amounting to $273 million in 1967 represented 23.9 percent of total exports with petroleum products valued at $221 million accounting for the major portion. Imports of mineral commodities set at $319 million accounted for slightly more than 22 percent of total imports. Crude oil imports valued at $70 million accounted for 22 percent of this total. Kuwait was Singapore's major source of crude oil, having provided $54 million worth. The value of Singapore's total trade, mineral commodity trade, and net trade balance for 1966 and 1967 was as follows:

[9] Prepared by Arthur F. Grube, industry economist.

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	Value (million dollars)		Mineral commodities' share of total (percent)
	Mineral commodities	Total trade	
Exports:			
1966	246	1,102	22.3
1967	273	1,141	23.9
Imports:			
1966	274	1,328	20.6
1967	319	1,440	22.2
Trade balance:			
1966	−28	−226	XX
1967	−46	−299	XX

XX Not applicable.

COMMODITY REVIEW

Metals.—*Aluminum.*—The Kawneer Company of Niles, Mich., a subsidiary of American Metal Climax, Inc., plans to erect an aluminum semifabricating facility in Singapore. The plant will have an annual capacity of 1,500 tons and will cost about $1 million. Future planning calls for increased capacity to provide an exportable surplus.[10]

Iron and Steel.—The National Iron and Steel Mills are currently planning to expand into an integrated steel plant with a capacity of 500,000 tons per year. The present capacity of the plant is 180,000 tons of finished products per year. The company obtains its scrap iron and steel

[10] Metal Bulletin. No. 5327, Aug. 27, 1968.

Table 11.—Singapore: Exports and reexports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal destinations, 1967
METALS			
Iron and steel:			
Iron and steel scrap	8,591	3,531	Japan 1,876; Malaysia 1,635.
Semimanufactures	119,537	112,853	Malaysia 88,487; Cambodia 8,827; Brunei 5,074.
Manganese ore	1,509	1,767	Malaysia 1,643.
Silver, unworked thousand troy ounces	1,160	1,886	United Kingdom 1,884.
Tin:			
Ore long tons	2,322	2,760	All to Malaysia.
Slag and hard head do	10	217	Belgium-Luxembourg 149; Netherlands 43.
Other forms do	761	803	Malaysia 207; United States 143; United Arab Republic 119.
NONMETALS			
Cement and clinker	32,085	31,131	Malaysia 11,901; Brunei 9,315; Cambodia 4,671.
Fertilizers, manufactured, all types	92,481	79,176	Malaysia 75,958; Philippines 2,500.
Natural phosphates	19,657	22,160	Malaysia 22,060.
MINERAL FUELS AND RELATED MATERIALS			
Petroleum:			
Crude thousand 42-gallon barrels (reexports).	53	--------	
Unfinished oils do	19	--------	
Refinery products:			
Aviation gasoline do	2,421	2,585	South Vietnam 1,690; Thailand 369.
Motor gasoline do	r 7,755	7,404	South Vietnam 3,680; Malaysia 784; Australia 570.
Kerosine do	2,114	2,677	South Vietnam 1,384; Hong Kong 347; Malaysia 230.
Jet fuel do	r 10,638	14,936	South Vietnam 8,858; Thailand 3,973; Hong Kong 770.
Distillate fuel oil do	11,582	12,990	South Vietnam 5,335; Malaysia 2,540; Hong Kong 1,372.
Residual fuel oil do	r 18,114	20,860	Japan 9,926; Hong Kong 4,439; Netherlands 3,001.
Lubricating oils do	680	702	Thailand 302; Malaysia 204; Burma 85.
Asphalt do	312	342	Malaysia 77; South Vietnam 69; Cambodia 55.
Other do	26	51	Malaysia 20; Hong Kong 12; Thailand 7.
Total do	r 53,642	62,547	

r Revised.

Source: Department of Statistics, Singapore External Trade Statistics, 12 months ended December 1966 and 12 months ended December 1967.

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Table 12.—Singapore: Imports of selected mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967	Principal sources, 1967
METALS			
Aluminum:			
Bauxite	62,061	300	Mainland China 300.
Metal and alloys, all forms	3,158	3,254	Japan 936; Hong Kong 584; Belgium-Luxembourg 498.
Copper, all forms	2,784	3,270	Malaysia 1,041; Japan 1,040; Australia 392.
Iron and steel:			
Iron and steel scrap	24,390	35,826	Malaysia 29,915; Christmas Island 2,845; Australia 1,374.
Pig iron and ferroalloys	11,378	22,540	U.S.S.R. 18,769; mainland China 1,700; Norway 1,006.
Ingots and other primary forms	5,186	22,813	Australia 9,553; unspecified Asian countries 6,850; mainland China 2,489.
Semimanufactures	238,000	261,216	Japan 152,465; United Kingdom 27,012.
Manganese ore	5,666	4,097	Unspecified African countries 4,095.
Silver, unworked, troy ounces	3,011	14,028	France and Monaco 7,857; United Kingdom 4,499; Sarawak 1,094.
Tin:			
Ore, long tons	1,309	1,446	All from Malaysia.
Other forms, do	597	627	Malaysia 545; United Kingdom 39.
Zinc, all forms	4,817	4,835	Japan 3,423; Canada 615; Australia 359.
NONMETALS			
Cement and clinker	420,744	485,725	Japan 197,904; Malaysia 171,339; Taiwan 113,515.
Fertilizers, manufactured, all types	81,197	102,008	West Germany 37,197; Canada 19,111; U.S.S.R. 9,023.
Natural phosphates	22,926	18,849	Christmas Island 11,069; United States 4,948; Israel 2,654.
MINERAL FUELS AND RELATED MATERIALS			
Coal	3,895	79	Malaysia 54; United States 25.
Coke	3,566	4,356	Taiwan 1,782; Netherlands 1,335.
Petroleum:			
Crude, thousand 42-gallon barrels	25,086	38,257	Kuwait 29,860; Iran 4,502; Iraq 2,458.
Unfinished oil, do	1,677	1,939	All from Malaysia.
Refinery products:			
Aviation gasoline, do	2,432	2,870	Iran 2,150; Netherlands Antilles 494.
Motor gasoline, do	5,058	4,530	Iran 1,944; Malaysia 1,174; India 759.
Kerosine, do	2,797	2,321	Malaysia 1,511; Iran 454.
Jet fuel, do	8,226	11,719	Malaysia 4,358; Iran 3,306; Netherlands Antilles 1,387.
Distillate fuel oil, do	8,020	8,397	Kuwait 2,908; Malaysia 1,466; Saudi Arabia 1,126.
Residual fuel oil, do	22,383	23,260	Malaysia 9,505; Kuwait 5,864; Iran 1,532.
Lubricating oils, do	863	839	Netherlands Antilles 533; Australia 97; United States 87.
Asphalt, do	37	20	Netherlands 7; Malaysia 5; United Kingdom 3.
Petroleum coke, do	118	428	Malaysia 426.
Other, do	20	22	United States 7; United Kingdom 3; Netherlands 2.
Total, do	49,954	54,406	

Source: Department of Statistics. Singapore External Trade Statistics, 12 months ended December 1966 and 12 months ended December 1967.

from detinning and ship-breaking operations conducted in Singapore.

Nonmetals.—*Cement.*—A joint Japanese-Singapore-owned cement plant was under construction at yearend 1968. The plant, being built by Mitsui & Co., Ltd. and Onoda Cement Co., Ltd., both of Japan, and Hong Keon and Company of Singapore, will have a capacity of 20,000 metric tons per month. Completion date is set for the end of 1969.

Mineral Fuels and Related Materials.—*Petroleum.*—In September 1968 Esso Standard Eastern, a subsidiary of Standard Oil Company (New Jersey) and the Government of Singapore's Economic Development Board announced that Esso would build Singapore's fourth refinery on Pulau

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Ayer Chawan, an island 1 mile offshore from the Jurong Industrial Estate. The plant will have a crude distillation capacity of 80,000 barrels per day, making Singapore's total refinery capacity about 245,000 barrels per day. The new plant will be owned and operated by a wholly owned subsidiary of Standard Oil Company (New Jersey), Esso Singapore Private, Ltd. The Esso investment will total approximately $65 million including development work on the island and the approach channel. Completion is set for 1971. Contracts have been signed with Japan's Chiyoda Chemical Engineering for the construction of the refinery and tankage, Santa Fe-Pomeroy for marine facilities, and Dillingham for site preparation.

During 1968 Singapore's existing three refineries processed about 62,719,000 barrels of crude oil, an alltime high. The significantly increased refinery throughput of crude oil was primarily due to the expanded capacity of Shell Refining Company (Singapore) Ltd.'s refinery at Pulau Bukom. During the year this refinery's capacity was doubled, from 60,000 to 120,000 barrels per day. At yearend 1968 Singapore's three refineries had a crude distillation capacity of 165,000 barrels per day.

NORTH VIETNAM [11]

Compared with South Vietnam, North Vietnam is much more richly endowed with minerals and has more industries. Resources of anthracite coal and apatite are particularly significant, and the country has many workable deposits of construction raw materials, chromite, iron ore, lead–zinc, phosphate rock, clays, and sands, among others. North Vietnam also has a small integrated steel mill, several cement plants, and various fertilizer plants. Plans were afoot to build aluminum and zinc plants. Although bombing of key mines and installations in 1967 disrupted production, the background is presented herewith to show what might be developed and rebuilt.

Performance of the mineral and related industries was uneven for 1968. The bombing halt at midyear probably revived various activities. Value of coal output reportedly increased 27 percent over 1967 value. Production of phosphate ores (apatite and phosphate rock) and chemical fertilizers probably was higher than in the previous year. Chromite apparently held its own. Steel and cement probably did not register significant gains, because of the difficulty in rebuilding key facilities such as the Thai Nguyen steel complex and the Haiphong cement plant. In general the North Vietnamese did not do as well as hoped for in 1968, in view of their claim that targets for coal mining, electricity, and chemicals were only 50 percent to 80 percent achieved.

Before bombing damaged the well-known Hongay anthracite mines, annual coal production was close to 3.5 million metric tons. War damage brought output down considerably in 1967, and total recovery was far from achieved in 1968. Surplus anthracite has gone abroad, with Japan importing 283,567 tons in 1968. Production of iron ore and steel, about 300,000 tons and 150,000 tons yearly, respectively, prior to the bombing, probably has been fairly small in recent years since there is no indication that Thai Nguyen has been rehabilitated. The country's cement industry was producing at about 750,000 tons yearly; output in 1968 probably was not much more than half a million tons. North Vietnam has been producing annually about 30,000 tons of chromite (from Co Dinh) and 150,000 tons of salt for some years. Apatite from the extensive Laokay deposits near the Chinese border has been about 1 million tons per year. In contrast, phosphate rock production seldom exceeded 50,000 tons annually. More than half a dozen chemical fertilizer plants (100,000 to 200,000-ton size) have been built in the country. The Soviet Union exported about 1.8 million barrels of petroleum products to North Vietnam during 1967, and imported 40 tons of tin. Apatite went to East Europe and mainland China, which also took chromite and a little anthracite. As noted, Japan has been an important importer of North Vietnamese anthracite.

At the beginning of 1969 North Vietnam

[11] Prepared by Arnold M. Lansche, physical scientist, and K. P. Wang, chief, area specialist, Far East and South Asia.

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was reportedly seeking Japan's technical and economic cooperation in future rehabilitation. Aid from Japan was sought for the development of coal mining, oil refining, glass manufacturing, and nonmetallic mineral industries.

SOUTH VIETNAM [12]

The mineral industry of South Vietnam remained static during 1968 because of wartime difficulties, with production limited almost entirely to relatively small quantities of cement, salt, clay, and sand. Continuous unrest and political instability has precluded thorough geological surveys to determine the nature and extent of the country's mineral resources. Nonetheless, up-to-date statistics on production and trade of mineral and related products were available from a publication by the National Institute of Statistics entitled Monthly Bulletin of Statistics.

Cement, the principal mineral product, suffered a 19-percent decline in output, as compared with 1967. The country's cement production has fluctuated as follows, in thousand metric tons: 1964, 75; 1965, 189; 1966, 135; 1967, 181; and 1968, 145. Most of the cement comes from the Ha Tien-Thu Duc plant on the Gulf of Siam. Demand far exceeds local supply, necessitating large imports. Cement imports amounted to 365,415 metric tons in 1966 valued at $9.5 million ($3.3 million at free market rate)[13] and 476,213 tons in 1967 valued at $10.3 million ($5.1 million at free market rate), with the bulk coming from Taiwan, including 471,312 tons in 1967. For the first 10 months of 1968, only about 203,000 tons of cement was imported.

Annual salt production probably showed little change from the 160,000 tons estimated for the last few years. Clays were for the domestic market, but some high-quality glass sands have been exported after satisfying domestic needs. Japan took nearly 100,00 tons of glass sands from South Vietnam in 1962, but only 11,600 tons in 1968. Presumably small amounts of coal were also produced in 1968.

During 1967 South Vietnam's balance of trade continued to deteriorate, with the total value of imports reported at $532 million ($262 million at free market rate), as compared with exports of only $16.1 million ($7.9 million at free market rate). In 1966 total imports were valued at $459 million ($158 million at free market rate), compared with exports of $24 million ($8.3 million at free market rate). A large proportion of South Vietnam imports, however, were not a drain on the country's own foreign exchange holdings because they were related to military requirements reimbursable from foreign accounts.

With limited facilities to manufacture steel products, South Vietnam has had to rely almost totally on imports. Valuewise, steel heads the list of industrial imports. Reportedly, the country imported 307,309 metric tons of steel products in 1966 valued at $50 million ($17 million at free market rate) and 232,996 tons in 1967 valued at $46 million ($23 million at free market rate).

Petroleum ranks next to steel as an import product. South Vietnam has no refinery, although a 40,000-barrel-per-day plant has been proposed for Nha Trang. Meanwhile, all needs were met by imports of refined petroleum products. Petroleum imports amounted to 7.9 million barrels in 1966 valued at $22 million ($8 million at free market rate) and 7.2 million barrels in 1967 valued at $28 million ($13.8 million at free market rate). Two-thirds of the above came from Singapore. Direct imports for U.S. military use presumably were not included in Vietnam statistics. Principal oil products imported in 1967 were as follows, in barrels: gasoline, 1,344,000; kerosine, 1,223,000; distillate fuel oil, 1,019,000; and residual fuel oil, 1,974,000.

Fertilizer imports fluctuated from 35,000 metric tons in 1966 to 1,400 tons in 1967, and 25,000 tons in the first 10 months of 1968. Little progress was made toward the

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[12] Prepared by Arnold M. Lansche, physical scientist, and K. P. Wang, chief, area specialist, Far East and South Asia.

[13] Official rates of exchange, VN piasters to US$1, were as follows: 1966, 61.86; 1967, 80.80; 1968, 80.80. Corresponding free market rates of exchange, VN piasters to US$1, were as follows: 1966, 180.07; 1967, 163.94; 1968, 188.96.

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construction of a fertilizer plant at An Hoa. South Vietnam produced about 12,500 metric tons of glass (bottles) in 1967, compared with 15,600 tons of imports. To meet local demand the country also imported about 6,000 tons of ceramic products in 1967, 4,000 tons of copper products, and 7,000 tons of aluminum products.

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The Mineral Industry of Other South Pacific Islands

By John A. Stock[1]

CONTENTS

	Page		Page
British Solomon Islands	971	New Caledonia	974
Christmas Island	972	New Hebrides	976
Fiji Islands	972	Papua and New Guinea	977
Nauru and Ocean Island	974		

BRITISH SOLOMON ISLANDS

Mineral production in the British Solomon Island Protectorate (BSIP) is limited to a small output of gold annually which is exported to Australia. Among the larger islands of BSIP which include Choiseul, New Georgia, Santa Isabel, Malaita, Guadalcanal, San Cristobal, and Santa Cruz, Guadalcanal is the source of most of the gold production. Gold is recovered from alluvial deposits by natives using panning methods. Production for 1968 is not available, but gold output was 672 troy ounces in 1967 and was valued at $19,322.

Total exports of BSIP in 1967 were valued at $5.5 million, but only about $83,000 was accounted for by mineral exports which consisted of gold and scrap metal. Imports totaled $9.2 million and included about $1 million in mineral commodities. Mineral fuels and primary metals and semimanufactures were the largest valued of imported mineral commodities.

Interest in BSIP has resulted in a number of geophysical surveys in recent years; a United Nations sponsored aerial survey was completed in late 1966. Ground investigation of the anomalies from this latest survey was begun immediately by the BSIP Geological Survey. For a time, all areas with anomalies were closed to prospecting. Surface prospecting of 133 anomalies disclosed four areas that were considered important. In mid-1968 the Legislative Council removed all areas flown, except the four important areas, from Government protection and permitted them to be awarded to the highest bidder for prospecting. Two of the four areas, the bauxite prospect in western Rennell Island, and the area of copper mineralization on the Kouloula River of Guadalcanal were to be open to development proposals to be submitted before March 31, 1969, by interested parties. The other two areas included an extension of a known manganese deposit on Santa Isabel and a nickel sulfide vein on International Nickel Southern Ltd.'s concession on San Jorge Island.

Hopefully, prospects on Florida and other islands may be assessed so as to interest private mining interests sufficiently to prove them at their expense. The vein on San Jorge was scheduled for exploratory drilling in 1968 and if nickel sulfide is confirmed, much detailed prospecting will take place. Amax Bauxite Corp. of

[1] Mining engineer, Division of International Activities.

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Australia and Conzinc Riotinto of Australia reportedly applied for licenses to mine bauxite on Rennell Island in late 1968. The ore grade promises to average 75 percent gibbsite (45 percent alumina) with some U_3O_8 which may constitute a valuable byproduct. It has been reported that Amax does not intend to continue exploration on Santa Cruz because the bauxite grade is too low. Mitsui Mining and Smelting Co. completed a survey on the southern half of Rennell Island and confirmed bauxite reserves of more than 36 million tons. Mitsui plans to explore the deposits fully for a year and may start development by 1971.

CHRISTMAS ISLAND

The mining and exportation of bulk phosphate rock and bagged phosphate dust is the only industrial activity on Christmas Island, an Australian territory in the Indian Ocean. There are a number of phosphate deposits, owned equally by the Australian and New Zealand Governments. The largest deposit is at South Point. A preliminary survey by the Australian Bureau of Mineral Resources estimates phosphate reserves at a minimum of 200 million tons, and three grades have been identified. Under a new agreement signed in June 1968, the British Phosphate Commissioners (BPC) will continue to be employed as managing agents by the Christmas Island Phosphate Commission (CIPC), but the CIPC will take over the purchase, stockpiling, and distribution of phosphate produced for agricultural purposes in Australia and New Zealand.

About 99 percent of the phosphate rock shipped to Australia is used in the manufacture of superphosphate and the remainder is used in stock feed and for experimental purposes.

Total certified exports of rock and dust phosphate by destination for recent years were as follows, in metric tons:

Fiscal year ending June 30 of year stated	Australia	Singapore and Malaya	Borneo	New Zealand	Total
1963	559,599	74,074	3,781	----------	637,454
1964	764,081	67,988	----------	----------	832,019
1965	779,902	76,916	----------	----------	856,818
1966	781,585	77,169	----------	20,803	879,007
1967	808,725	96,826	----------	208,113	1,113,664
1968	891,454	70,674	----------	183,759	1,145,887

More than half of the island's total imports consist of fuel oil and gas oil, and receipts of these commodities were 30,175 tons in 1966–67 and 23,845 tons in 1967–68.

A program to increase phosphate output to 1.6 million tons per year is continuing, and the Australian Bureau of Mineral Resources and CIPC are studying ways of further increasing annual output to 2.3 million tons.

FIJI ISLANDS

A colony of the United Kingdom, the Fiji Islands are situated about 2,700 kilometers east-northeast of Brisbane, Australia, and consist of two major islands, Viti Levu and Vanua Levu, as well as many smaller islands. In order of value, minerals produced are gold, cement, stone, sand and gravel, copper, manganese, silver, lime, and limestone. Currently, bauxite deposits are being explored.

The value of Fijian mineral production in 1968 is estimated at $6.8 million,[2] an increase of about 1.5 percent from that in 1967. Gold declined to 55 percent of the total value, and cement at 22 percent was a small increase.

[2] As a result of devaluation on Nov. 19, 1967, the rate of exchange for the Fijian pound decreased from US$2.50 to US$2.15. Decimal currency introduced on Jan. 13, 1969, made F£1 equivalent to F$2. Consequently, all values given herein have been converted at F£1 equals US$2.50 through 1967 and at F$1 equals US$1.08 thereafter.

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Table 1.—Fiji: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968
METALS					
Copper, mine output, metal content	-------	-------	-------	2	•840
Gold, mine output, metal content—troy ounces	100,493	109,095	112,567	111,028	106,784
Iron ore, concentrate—thousand tons	-------	3	-------	-------	-------
Manganese, ore and concentrate, gross weight	911	5,479	5,326	5,939	8,554
Silver, mine output, metal content—troy ounces	60,564	60,470	67,499	61,335	54,518
NONMETALS					
Cement, hydraulic	30,971	39,616	40,855	47,373	51,396
Lime	3,471	3,222	2,445	2,821	3,374
Stone, sand and gravel:					
Limestone	-------	18,347	NA	11,661	[1] 1,315
Quarried stone, other—cubic meters	182,793	295,522	314,867	275,882	212,909
Sand and gravel—do	222,281	510,135	•377,000	295,618	•306,000
Sand (coral)—do	27,524	32,871	39,583	[2] 59,863	[2] 62,459

• Estimate. NA Not available.
[1] Quantity in cubic meters.
[2] Quantity in metric tons.

Table 2.—Fiji: Exports of principal mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
Copper, ore and concentrate	1	1
Gold, (in bullion)—troy ounces	109,782	112,698
Manganese, ore and concentrate.	5,171	4,430
Nonferrous base metal scrap	-------	8
Silver [1]—troy ounces	67,783	61,690

[1] Contained in gold bullion.

Table 3.—Fiji: Imports of principal mineral commodities

(Metric tons unless otherwise specified)

Commodity	1966	1967
METALS		
Aluminum, metal, including alloys, semimanufactures	50	39
Copper, metal, including alloys, semimanufactures	60	48
Lead, metal, including alloys, semimanufactures	53	69
Tin, metal, including alloys, semimanufactures	278	182
Steel:		
Primary forms	413	294
Semimanufactures	10,315	13,079
Other: Nonferrous metals, including alloys, semimanufactures	99	114
NONMETALS		
Cement	681	354
Fertilizer materials	23,468	24,252
Salt (excluding brines)	2,231	1,992
MINERAL FUELS AND RELATED MATERIALS		
Coal	2,085	5,691
Coke	269	174
Petroleum, refinery products:		
Gasoline and benzine thousand 42-gallon barrels	252	263
Kerosine and jet fuel—do	488	574
Diesel oil—do	512	510
Residual fuel oil—do	150	135
Lubricants—do	18	19
Other: Bitumen—do	10	12

In Fijian trade, the export of metallic mineral commodities is second only in value to the primary export of sugar, and is a significant part of the economy of Fiji.

In 1967 the value of mineral exports and imports represented about 10 and 17 percent, respectively, of total exports and total imports. Mineral exports increased about 4 percent in 1967 to $4.21 million while mineral imports increased 12 percent to $11.73 million. Almost 96 percent of the value of mineral exports was accounted for by gold and silver whereas principal imports of mineral commodities were comprised of refined petroleum products ($7.5 million), steel semimanufactures ($2.3 million), and fertilizers ($1.3 million).

In mid-1968, the Bauxite Fiji Co. Ltd. was established to exploit bauxite reserves in Fiji. The company is wholly owned by the Nippon Light Metal Co. (50 percent), Showa Denko K.K. (25 percent), and the Sumitomo Chemical Co. (25 percent), all of Japan. A 2-year study on Vanua Levu provided an estimate of about 6 million tons of bauxite, but the company plans a 1-year exploration and development program in the Wainunu River basin in 1969 to determine the extent and alumina content of the deposits. Annual shipments of bauxite to Japan are expected to amount to at least 250,000 tons.

Although the sudden increase in copper output in 1968 apparently originates from the copper deposit being worked by the Japanese owned Banno Mining Co. Ltd. on Vanua Levu, in mid-1968 the removal of overburden revealed that the supposed con-

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tinuous deposit was made up of small separate deposits. The current reserve estimate is 46,000 tons or one-third of the original estimate. Banno is now prospecting other nearby areas in an effort to make good its $3 million investment on Vanua Levu.

The Amad N.L. Company reported encouraging results at the completion of sampling of a copper deposit in Fiji in early 1969. Additional detailed work on this deposit will probably follow.

The Emperor Gold Mining Co. Ltd. at Vatukoula on Viti Levu has found it economical to mine lower grade gold ores as a result of the introduction of two-tier gold pricing. Inasmuch as its reserve and financial position has been improved by this, an amendment to the subsidy arrangement with the Fiji Government has been agreed upon. The amendment stated that any subsidy payment the company did not take up within a calendar year would not be paid at all. Offshore search for gold and other metallics is to be made in early 1969 near the two major islands by the Crawford Marine Specialists, Inc., of California. Initial investigations will be for heavy minerals at the mouth of the river which drains the Vatukoula caldera.

Increased production of manganese ore possibly reflects the operation of the new Vunimoli No. 1 and No. 2 mines as planned in 1967, and cessation of exports of New Hebrides ore to Japan may account for increased exports of Fijian manganese ore to Japan.

NAURU AND OCEAN ISLAND

The Republic of Nauru and Ocean Island in the British Gilbert and Ellice Islands Colony produce only phosphate rock. These islands supply most of the requirements of Australia and New Zealand. In 1968, however, some rock was shipped to Japan.

Total value of phosphate rock shipped in 1968 was $33.9 million, an increase of about 23 percent from 1967. Production, all of which has been exported, for recent calendar years for Nauru and Ocean Islands is as follows:

Year	Thousand metric tons		
	Nauru	Ocean Island	Total
1964	1,849	328	2,177
1965	1,480	365	1,845
1966	2,037	380	2,417
1967	1,798	452	2,250
1968	2,254	528	2,782

Despite the attainment of independence in January 1968, the Republic of Nauru is committed to supply Australia and New Zealand with phosphate rock until 1970. Operation and management of the industry is by the British Phosphate Commissioners (BPC), but by 1970 the transfer of BPC's assets to the Nauruans will be completed, and the Nauru Phosphate Commission (NPC) will assume control and marketing of phosphate rock production. A vessel has already been ordered by the Nauruans for shipping the mineral. Although the annual supply of phosphate rock through the BPC is about 2 million tons, during fiscal years ending in June 1967 and June 1968 bad weather prevented the loading of the full quota of rock. To dispose of this excess rock, permission was granted by the BPC (representing Australia, New Zealand, and United Kingdom) for it to be sold on the world market. Mitsubishi (Australia) Pty. Ltd. of Japan contracted to import a total of 500,000 tons into Japan between October 1968 and June 1970. The first shipment of 13,000 tons left Nauru in October 1968, and a total of 36,679 tons was shipped through December 1968. The contract price of about $16 per ton is $3 higher than paid by the BPC, and foreshadows a higher price to Australia and New Zealand after 1970.

NEW CALEDONIA

The island of New Caledonia, an overseas territory of France, lies in the South Pacific Ocean about 1,370 kilometers east-northeast of Brisbane, Australia. Despite its small size (about 65 kilometers by 400 kilometers), this island was rated in 1967 as the third largest world producer of nickel.

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PRODUCTION

The record tonnage of nickel ore produced in 1967 was surpassed 37 percent by the alltime record of 5,220,000 metric tons in 1968. The nickel-cobalt content of this output was estimated at 111,875 tons.

TRADE

New Caledonian mineral exports totaled $102 million in 1968, an increase from the previous year's value of $77 million. These exports included smelter products, nickel ore and iron ore. Chromite production and export ceased in 1968 following an unsuccessful attempt to establish a mining operation in 1967. Small quantities of giobertite, a magnesium carbonate, were also produced for use locally in refractories. Ferronickel of all grades accounts for 43 percent of the value of minerals exported, and nickel ore and matte account for 30 and 26 percent, respectively.

COMMODITY REVIEW

Metals.—*Iron Ore.*—Iron ore was produced at the Prony mine and shipped to Broken Hill Proprietary Company Limited in Australia. The amounts mined and exported have declined in recent years and in 1968 the sales contract was not renewed and the mine was forced to close.

Nickel.—The record production of nickel ore from Société le Nickel's mines (possibly those at Thio, Bornets, Kouaoua, Poro and Nepoui) and other local mining concerns totaled 5.2 million tons averaging 2.80 percent nickel plus cobalt. Of this, 2.7

Table 4.—New Caledonia: Production of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1964	1965	1966	1967	1968 p
METALS					
Chromite (51–53 percent chromium oxide)	------	--------	--------	r 1,238	--------
Iron ore (55–56 percent iron)—thousand tons	307	279	220	204	172
Nickel:					
Ore [1]—do	2,615	2,648	2,892	r 3,820	5,220
Metallurgical products: [2]					
Ferronickel (nickel-cobalt content)	13,207	15,552	20,272	20,656	22,425
Matte (nickel-cobalt content)	13,298	15,816	14,153	13,840	14,894
NONMETALS					
Giobertite [3]	1,007	755	635	r 1,558	664

p Preliminary. r Revised.
[1] Mine-run ore, abour 25 percent water; nickel content 2.8–3.5 percent by dry analysis.
[2] Ferronickel grading 24–28 percent nickel-cobalt, matte about 79 percent nickel-cobalt.
[3] Magnesian mineral used for refractories.

Source: Mines Service of New Caledonia.

Table 5.—New Caledonia: Exports of mineral commodities

(Metric tons unless otherwise specified)

Commodity	1967	1968	Principal destinations, 1968
Chromite	1,233	-------	
Iron ore	198,236	197,555	All to Australia.
Nickel ore—thousand tons	1,528	2,489	All to Japan.
Smelter products: [1]			
Ferronickel:			
Electric grade (FN4 grade, 25.1 percent nickel-cobalt).	7,767	10,098	France 7,339; United States 2,279.
Sulfur extracted (FN3 grade, 24.5 percent nickel-cobalt).	3,393	3,872	France 3,687; West Germany 172.
Refined (FN2 grade, 26.3 percent nickel-cobalt).	174	351	France 333; Austria 18.
Overrefined (FN1 grade, 27.5 percent nickel-cobalt).	7,822	8,566	France 8,226; Sweden 115.
Matte: Nickel matte (79 percent nickel-cobalt)	12,983	15,708	France 6,418; Japan 4,896; Canada 4,394.

[1] Data in terms of contained nickel plus cobalt.

Source: Mines Service of New Caledonia.

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Table 6.—New Caledonia: Imports of mineral commodities

(Metric tons)

Commodity	1967	1968
METALS		
Semimanufactures, not further described	8,157	7,938
Metals, not further described	11,567	17,218
NONMETALS		
Cement	37,881	50,291
MINERAL FUELS AND RELATED MATERIALS		
Coal	247,565	236,077
Petroleum products	215,313	301,450

million tons was smelted at Le Nickel's Doniambo metallurgical plant on the island and 2.5 million tons shipped to Japan. Although France was the chief destination for smelter products, various amounts were sold to other European countries immediately after shipment to France or after refining in Le Nickel's Le Havre plant. Because of rising Japanese demands and decreasing ore grade, exports of crude ore to Japan are expected to increase rapidly.

In addition to Le Nickel, the primary nickel producer in New Caledonia, there are two other groups with an interest in developing nickel deposits.

Le Nickel has begun an expansion program in order to increase metallurgical production by 1970 to about 65,000 tons of contained nickel. The cost is estimated to be $120 million of which Kaiser Aluminum and Chemical Corp. of the United States will provide part. Kaiser has also jointly formed two subsidiaries with Le Nickel, the Société Caledonienne du Nickel (which finances installations in New Caledonia) and Kaiser-Le Nickel Corp. (which markets ferronickel in the United States). Le Nickel in a later expansion may exploit huge low-grade nickel laterite ore using the Sherritt Gordon process for which they obtained a licensing agreement in 1968. The second group includes the International Nickel Co. of Canada (Inco) which plans to establish a company with a French consortium in early 1969 to develop nickel resources. Inco will have a 40-percent ownership and the French group a 60-percent ownership although Inco will provide 60 percent of financing. The company will be the Cie. Francaise Industrielle et Miniere du Pacifique (Cofimpac).

In 1968, Inco and the French Government's Bureau de Recherches Géologiques et Minières (BRGM) in a drilling program outlined nickel ore reserves of about 2,000 million tons containing 1.2 to 1.7 percent nickel plus cobalt. If Canadian pilot-plant studies on the ore prove the feasibility of metallurgical treatment of the ore, about $203 million may be spent on the plant. It is expected that 45,000 tons of nickel will be produced annually from this hitherto untapped oxide ore, and the nickel will be shared equally by both partners. The third group may be planning exploitation of nickel reserves and may be either a Peñarroya-Amax group or Patino Mining Corp. Patino has an option on reserves which may exceed 100 million tons. While waiting for French approval, the company is continuing exploration and feasibility studies.

NEW HEBRIDES

Since 1961, the production of manganese ore and the export of sintered concentrates (agglomerates) has been an important factor in the economy of the Condominium of New Hebrides (jointly governed by France and the United Kingdom). Production has been entirely from the Forari mine on Vate (Efate) Island, and export has been almost entirely to Japan. Owned by the Compagnie Francaise des Phosphates de l'Oceanie, the output of Forari mine declined during 1968, and the mine was finally shut down in December 1968. Estimated export during 1968 was about 45,000 metric tons of agglomerates. The manganese content of the agglomerates had been about 49 percent, and reportedly this grade had declined; however, the immediate cause given for the shutdown is the lowered prices offered by the Japanese buyers.

Production and exports during the past 5 years were as follows:

Year	Metric tons	
	Production	Exports
1964	60,546	66,104
1965	66,710	81,650
1966	76,240	65,145
1967	71,400	72,746
1968 •	55,000	45,000

• Estimate.

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The Forari mine and its equipment were later purchased by a syndicate from New Caledonia. Recently, interest has been shown by Consolidated Gold Fields Australia Ltd. in the Forari mine, and there are plans to examine ways in which the mine may again be opened on a profitable basis.

PAPUA AND NEW GUINEA

Gold and silver currently account for the entire mineral production of the Australian administered territories of Papua and New Guinea. In addition to the main island, the territories also include the larger islands of Bougainville, New Britain, New Ireland, and Manus, as well as many small ones such as Misima Island. For years relatively small amounts of gold and silver have been produced and even these amounts have been decreasing consistently. Occurrence of a variety of precious and base metals has been known, but production has been small. Recently, however, the tempo of exploration for all types of minerals has increased with the discovery of copper on Bougainville and natural gas in Papua. Most petroleum activities occur in Papua while most exploration for metals occurs in New Guinea.

The value of mineral production for the fiscal year ending June 30, 1968, was about $960,000,[3] a decrease of about 13 percent from 1967 value. This production represented about 0.2 percent of the territorial gross national product estimated at $450 million.

Statistics on the mineral industry in the territories during recent years follow:

[3] The Territories of Papua and New Guinea adopted the Australian decimal currency (on the basis of 1£ equals A$2) concurrently with its introduction in Australia on February 14, 1966. The current exchange rate of about A$1 equals US$1.12 has been used to convert all values herein to U.S. dollars.

Fiscal year ending June 30 of year stated	Mineral areas held (acres)	Number of mines	Number of workers [1]	Value of mineral output
1964:				
Papua	929	26	544	$1,370
New Guinea	11,339	358	3,508	1,511,639
1965:				
Papua	890	87	688	1,965
New Guinea	12,246	380	3,629	1,205,312
1966:				
Papua	881	86	557	1,978
New Guinea	10,590	399	3,915	1,058,681
1967:				
Papua •	NA	NA	NA	r1,322
New Guinea	12,409	358	4,018	1,022,164
1968:				
Papua •	NA	NA	NA	1,446
New Guinea	7,220	357	4,453	956,692

• Estimate. r Revised. NA Not available.
[1] Includes workers employed in petroleum exploration.

PRODUCTION

Mineral production for Papua and New Guinea for recent calendar years follows:

Minerals	1964	1965	1966	1967	1968
Gold—troy ounces	38,977	32,494	28,106	27,671	26,144
Silver—do	23,206	19,664	18,052	17,176	18,139
Platinum—do	1	4	(1)	--------	--------
Manganese ore—metric tons	2	--------	--------	--------	--------

[1] Less than 1 unit.

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TRADE

The trend in territorial trade during the fiscal years ending June was as follows:

	Value (million dollars)	
	Mineral trade	Total trade
Exports:		
1966	[1] 1.1	55.8
1967	[1] 1.0	59.6
1968	[1] 1.0	[2] 81.0
Imports:		
1966	12.5	124.0
1967	14.1	141.0
1968	[2] 14.8	[2] 159.0
Trade balance:		
1966	—11.4	—68.2
1967	—13.1	—81.4
1968	[2] —13.8	[2] —78.0

[1] Excluding reexports.
[2] Estimate based on 9 months' data.

COMMODITY REVIEW

Metals.—*Copper.*—Bougainville Copper Pty. Ltd. in late 1968 estimated the reserves of the low-grade copper deposit at Panguna Flats, Bougainville Island, to be a total of 914 million metric tons. Bougainville Copper, the operating company for the mining project, is jointly owned by Conzinc Riotinto of Australia Ltd. and New Broken Hill Consolidated Ltd. Of the total estimated reserves, 772 million tons average 0.47 percent copper and 0.02 troy ounce of gold per ton and can be mined by open-pit methods. The remaining ore is lower grade, is deeper, and was located by drilling. Seven Japanese companies (Mitsubishi, Nippon, Dowa, Furukawa, Mitsui, Sumitoma and Toho) have been negotiating with Bougainville Copper for the purchase of copper concentrate for a period of from 10 to 15 years beginning in 1972. It is expected that shipments of concentrate will amount to at least 50,000 tons of contained copper per year, and because of a gold shortage in Japan, the Japanese will also buy the gold content. Negotiations include a proposal that the Japanese companies lend $50 million to Bougainville Copper for the development of mining and treatment facilities on the island.

During 1968 encouraging copper anomalies have been found in stream sediments by Pacific Island Mines in a 1-square-mile area on Misima Island of Papua. Gold exploration of the Umana lode was suspended earlier in the year in order to increase investigation of the copper anomalies.

Mount Isa Mines Ltd. of Australia has been exploring the northwest mountain area of New Guinea and has found indications of copper in streams around Goiniri. Kennecott, Anaconda, and Metals Exploration are also exploring in this area.

The Bureau of Mineral Resources has investigated the reserves of the old Astrolabe copper-gold field, 24 kilometers east of Port Moresby. Production in this area is expected to begin in 1970 inasmuch as recent exploration has shown that high-grade copper deposits still exist. At least 30,000 tons of copper ore containing up to 20 percent copper has been found in the Diamond orebody.

Gold and Silver.—Nearly half of all gold comes from alluvial workings in the Morobe district. The remainder of the gold and associated silver is obtained from lode mining at Wau, Edie Creek, and Kainantu in the mountains of eastern New Guinea.

Nickel.—Metals Exploration N.L. has been testing a lateritic nickel deposit underlying an iron laterite zone near the Ramu River about 60 kilometers inland from Madang, New Guinea.

Platinum.—There has been no platinum production since 1966, but in 1968 preliminary prospecting of an alluvial platinum deposit near Aitape in the Sepik district was favorably reported upon.

Mineral Fuels.—*Petroleum and Natural Gas.*—Exploration has escalated sharply in Papua-New Guinea during 1968. Some wildcat wells have produced gas and condensate, but no oil as such has yet been discovered in the area. The Phillips Australian Oil Co. has been the primary company engaged in offshore drilling in the Gulf of Papua. Companies having interests in the Phillips Australian Oil Co. are Phillips Petroleum Co., Sunray, Canadian Superior, and Anacapa Corp., but Phillips is the operator. In early 1968, Uramu No. 1A, Phillips' third well, was the first successful offshore well to produce gas, at a rate of over 22 million cubic feet per day. The fourth well, Orokolo No. 1, produced no significant shows of oil or gas nor did five subsequent wells. In August 1968, Pasca No. 1 well, at a depth of 2,200 meters, produced gas at a daily rate of 6.8 million cubic feet which contained about 100 barrels of condensate per million cubic feet of gas. Pasca No. 1 is situated in about 80 meters of water, 80 kilometers

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from shore near the Gulf's center. Phillips plans to drill Pasca A2 in early 1969. Oil Search Ltd. reported some gas shows from Ini No. 1 well in August. Ini No. 1 was drilled to 2,200 meters on Ini Island close to the shore by Esso Exploration and Production Australia under a farmout from Australasian Petroleum Co. Pty. Ltd. (owned by Oil Search, British Petroleum Oil Supplies, and Mobil Ltd.). Basin Oil N.L. negotiated with Marathon Petroleum Australia Ltd. and Continental Oil Co. of Australia Ltd. to earn a working interest in their territory and to drill their first exploratory well in Papua.

Others with exploration licenses were engaged in geological, aeromagnetic, and seismic surveys during 1968. Among these were Marathon-Continental, Continental-Cities Service, Australian Aquitaine-Japan Petroleum Exploration, British Petroleum, Continental General Exploration, and Union Oil Co. Nakoro Petroleum Corp., made up of Texas oilmen, has a 70-percent interest in any discovery on parts of the Marathon-Continental acreage.

In late 1968 Interstate Oil Ltd. planned seismic surveys near the mouth of the Fly River, western Papua. The area is held by Island Exploration Co. Pty. Ltd. (owned by Oil Search Ltd., BP and Mobil). If the surveys locate a suitable structure Interstate may drill a deep test well by late 1969 and by this Interstate will earn a 50-percent interest in Island Exploration's area.

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